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IMPROVED UPRIGHT DRYING MACHINE.

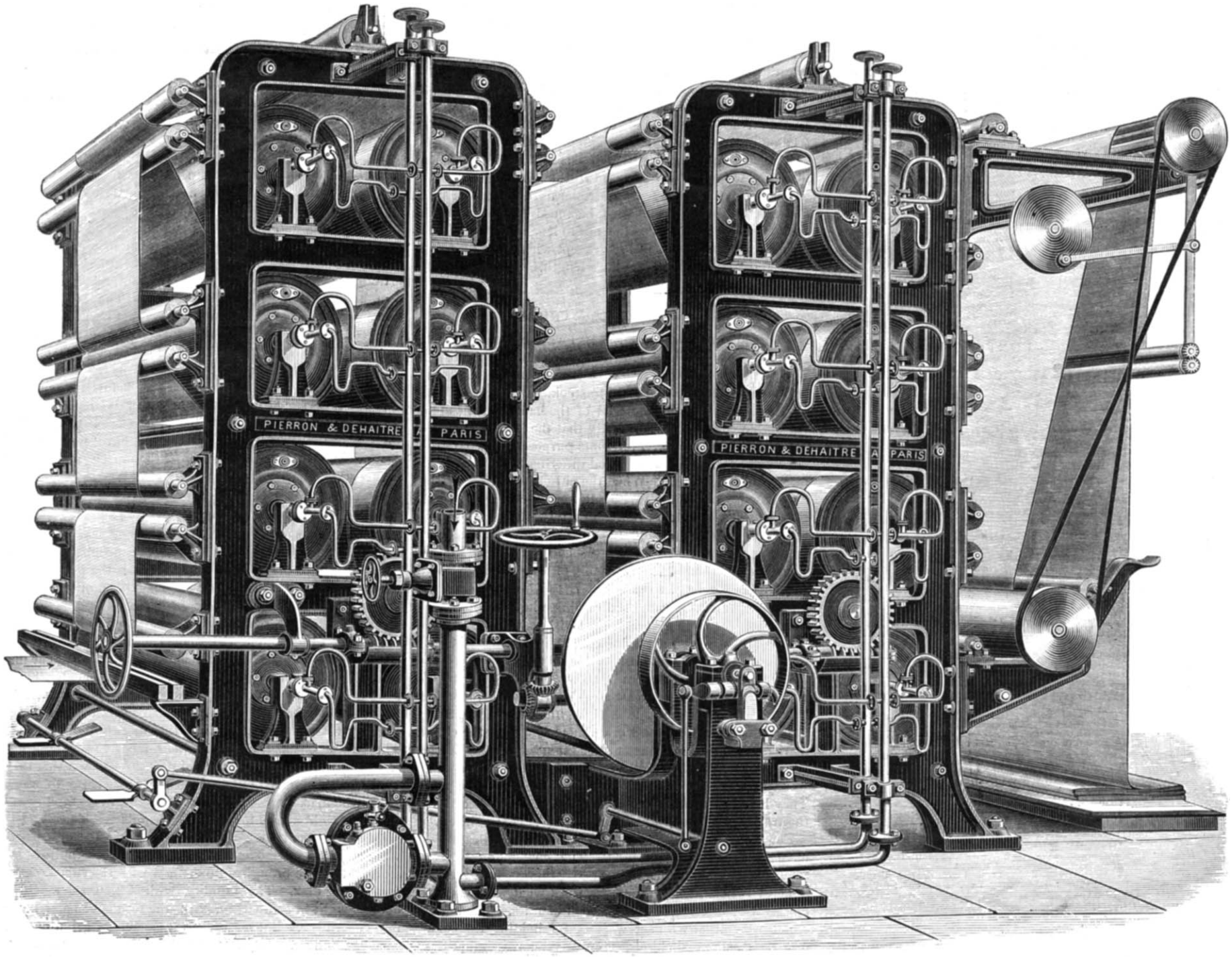
Opinions among finishers are divided as to the advisability of having the cylinders for drying the bleached or dyed and starched goods in two heights, disposed in a horizontal machine, or in several heights in a vertical machine. The former arrangement has, says the *Textile Manufacturer*, the advantage that every part of the machine and the cloth during its progress is visible and accessible, but this construction is very inconvenient where the machine assumes large dimensions, because then it requires a very large space; besides, the removal of the steam over such a large distance is more difficult. For this reason many finishers have lately given the vertical type the preference, for, in general, there is plenty of space in height in the drying room, and only the floor space is limited. In order to show those of our readers who take an interest in these machines a good type of such a vertical machine, we here reproduce an illustration of one made by French makers (MM. Pierron and Dehaitre, of Paris), a good model, which, however, on the whole, does not differ much from that of the best English machines. On reference to our illustration it will be found the machine shown contains sixteen cylinders, which, in their interior, contain the buckets now adopted by good makers for carrying off the condensed water. All pipes are placed on the gearing side. The machine is driven by a friction plate, which is in connection with a treadle in front of the machine, so that the attendant can stop the machine instantly as soon as he sees anything wrong. The machine contains, on the whole, as we said before, no new features, and is only a good example of its kind, but as the details are well brought out in our wood cut, our readers will be able to examine them easily.

Pneumatic and Chemical Extinguishers.

A correspondent asks us to tell him the difference between a pneumatic extinguisher and a chemical extinguisher, the former not having yet been introduced in his locality. The chemical extinguisher is a metal tank in which there is a solution of soda. A quantity of acid is held in some convenient receptacle, generally a glass bottle inside the tank, which, being turned into the solution of soda, generates carbonic acid gas by the mingling of the chemicals. A pressure is thus created which serves to project the liquid and the gas to a considerable distance. Carbonic acid gas is a sure extinguisher of fire when applied in even moderate quantities. The pneumatic extinguisher consists of a similar tank, inside of which is a small air-chamber; into this inner chamber air is forced by a pump until it is compressed several atmospheres. The space surrounding the air-chamber is then filled with a chemical compound which, on being brought in contact with heat, evolves carbonic acid gas. The pneumatic has an indicator that shows how much pressure there is in the air-chamber; when the machine is needed for service the air is permitted to escape from its confinement, and, being exceedingly elastic, exerts a pressure upon the compound sufficient to force it from the tank about the same distance a chemical can throw—thirty or forty feet. When these machines were first invented great difficulty was found in holding the air in the air-chamber, but this has been overcome; the gauge at all times indicates the amount of pressure, and so long as there is any it will, of course, project the stream. Water may be used instead of the compound if desired, but this is claimed to be far ahead of water for putting out fires. To state it briefly, the chemical extinguisher is dependent upon a gas generated within it for the pressure required to project a stream composed of fire-extinguishing chemicals; the pneumatic extinguisher depends upon compressed air, confined in an interior air-chamber, for a pressure with which to project either a chemical compound or plain water. Both kinds accomplish their purpose, which is to supply a small stream instantly for the extinguishment of incipient fires, and they have proved to be valuable auxiliaries to the other apparatus of fire departments. The same principle is applied to large machines, and nearly all the prominent fire departments have chemical engines, which render excellent and important service. The pneumatic principle as applied to extinguishers is comparatively new, it being but five or six years since the first of them were introduced.—*The Fireman's Journal.*

The Perfect Screw.

Professor W. A. Rogers produces a perfect screw by the following process: An ordinary well constructed lathe is used; and cuts of various depths are taken on a preliminary screw, for the purpose of tabulating the errors of the leading screw of the lathe as compared with a standard measuring bar. This being done, a micrometer screw is used to vary the relation between the leading screw and the cutting tool. This screw is kept moving automatically, or by hand, so as to always correspond with the tabulated values, which results in producing a screw nearly free from the errors of the leading screw. This screw is then ground with a nut cut in the same way; and, if not sufficiently perfect, it is then put in the place of the leading screw, and another screw cut from it by the same method, whereby any remaining errors are eliminated.



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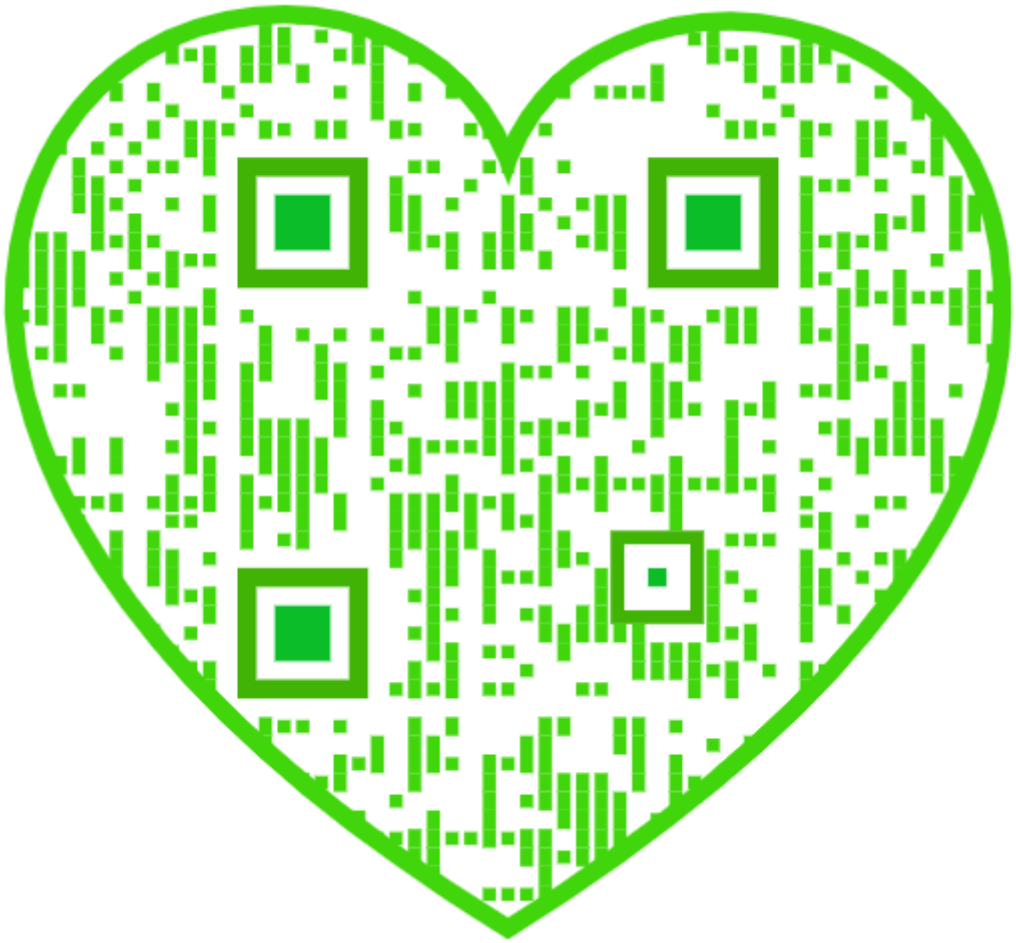

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SCRAPING SURFACES TO FIT.

There is no planer that planes planes. The best it can do is make a series of minute corrugations nearly parallel and nearly level. When a job of iron work comes from a planer, its planed surface is a series of longitudinal ridges traversed by cross chatter marks. Except in degree this description applies to all work done on the planer, whether the tool used was a roughing tool with rank feed or a finish tool with fine feed. Two planed pieces of cast iron laid face to face would present surfaces of contact very much like the plowed fields of clay soil, except in a less degree.

The first preparatory work to the scraping of surfaces to fit is testing with the straightedge, both longitudinally and across, to determine if the surface is out of wind. Inequalities are coarsely reduced by a float or mill file and afterward with a finish file, the straightedge being the guide. The finish file must be used with great care, for it is not its office to remove all the marks of the coarser file, or even to obliterate those of the planer tool; for both may present surfaces looser in texture than untouched portions, and thus be too quickly and unevenly cut away. All this preparatory work is to be done under the guidance of the straightedge—the surface plate has no part in it; the straightedge determines the lines of level, the truth of the surface, while the surface plate shows the quality of the surface.

A wash of spirits of turpentine put on with a rag is better than red lead to show surface. Soon as this is put on, place the surface plate on the surface of the filed work, and rub it back and forth. This will show the condition of the surface, which will be in blotches and dots. All these bright blotches and dots should be scraped down, the finer dots and lines less proportionally than the broader blotches, and another trial with turpentine and surface plate made, to be followed again by judicious scraping. It is not expected that working surfaces are to be as perfect as those of the test straightedges and the surface plates; the surface of the work should be even, without elevations or depressions, and should test to a straight line in all directions.

Scraping to fit is a slow, patience-demanding job; but it does not require the absolute exactness of the testing tools. Some of the tests for these are remarkable. When two surface plates, thoroughly clean, are laid together, one may be moved over the other at a mere touch, as though there was a film of ice between; the reason is that there is really a film of air between the surfaces, and it requires some force and movement to displace this air layer, when the plates will adhere so that one may be lifted by raising the other. Let one straightedge be laid on another, face to to face, and then move one end of the upper one transversely back and forth as though it was mounted on a pivot. After a few attempts a pivot will be found at a point about two-thirds or three-fourths of the entire length of the straightedge from the moving hand. But if these surfaces are left in contact for a while, they require force to separate them. A test was made of balancing a straightedge three feet long and weighing thirteen pounds on a human hair. It was placed on another straightedge, and the hair introduced between the two faces near the center. The upper one was moved on the hair as a roller until the proper point was reached, when it remained balanced perfectly, so that light could be plainly seen the entire length of the straightedge between the two surfaces, except where the hair separated them at the middle of their length.

HANDLES FOR COLD CHISELS.

The cold chisel is the crudest tool used by workers in the metals, albeit one of the most effective; it is a bar of cast steel with a wedge edge, varying from a parallel blade to a gradual thickening from edge to stock. Its work is always by percussion, and the material of the hammered head and the driven edge is the same, only that the latter is hardened and tempered. And yet, for some purposes, the cold chisel should have a handle of material differing from that of the bit or cutting portion. When the chisel is entirely of steel the blow is transmitted, with all its direct energy, to the edge. In many instances this blow "stunts" the edge, and leaves the thinner portion in the cut. Every "chipper" knows that much of his success depends on his skill in preventing this mishap. Yet for most of the ordinary work of the chipper the solid steel chisel is the best; on cast iron especially, and for starting and driving a keyway in wrought iron. But for the final chip, the finish, especially in yielding metals, as brass, wrought iron, and soft steel, is better done with a chisel that softens the blow before it reaches the cutting edge. This can be accomplished by means of a wrought iron chisel with cast steel bit, the two being welded together. With such a tool, light, thin, smooth shavings can be taken, leaving the work almost free from the chatter marks that necessarily accompany the use of the solid steel cold chisel. These chisels were tested many years ago, and were proved to be excellent for the finish work on a job. They have not come into general use, probably because of the trouble and cost of making and relaying the chisels.

For very delicate work, even wooden handles are—or have been—successfully used. The channeling of some small steel dies for working soft sheet brass could not be done by the solid chisel, but the work went well when the chisels were inserted in solid wooden handles. The handles which were fitted with screw jaws for holding the shanks of awls, small wood chisels, screw drivers, and similar tools, proved to be excellent for these light purposes. These wooden handles were fully as effective in chiseling by blows on copper and hard brass, when the solid steel chisel lodged in the metal or broke its edge if the blow was not in a direct line with the chisel.

The Only Foreign Policy Wanted.

We know of a vigorous foreign policy to which there is no possible objection. It is a policy of peace which misses no opening for an increase of trade between the United States and other countries. It affords scope for the largest statesmanship and for the freest employment of all the arts—save that of war. This is a policy loved by the people more than by ambitious rulers. It is devoid of noise, fuss, and pretension. We have seen it manifested within a year in the building of a railroad between the United States and the heart of Mexico. This one American enterprise, popular in its inception and completion, has done more to promote good will and quicken trade between the two countries than all the legislation of Congress since the Mexican war. Among its incidental interesting results is the movement for a meeting at St. Louis of the Mexican and American survivors of the war of 1846–47. This is the first assemblage of the kind ever convoked. It would not be possible but for the truly friendly relations which have sprung up between the veterans of Palo Alto, Monterey, Chepultepec, Contreras, and Cerro Gordo on both sides of the boundary, in direct consequence of the new railroad communication.

Private citizens can do much in this line of reciprocal kindnesses, but they cannot do everything. The tariff barriers which divide us from Mexico cannot be leveled except with the consent of our Government. Here now is an auspicious occasion for bringing into play a vigorous foreign policy that can hurt nobody, that will cost this country nothing, and will bind Mexico to our interests as tightly as if she were annexed as the result of an expensive war with her. There is no "jingoism" about this. There is no necessity for waiting of a new President, Republican or Democratic, to put this practical and feasible idea into execution. It can all be realized by the passage of the bill reported from the Ways and Means Committee to carry the Mexican treaty into effect. There is political capital in it for both parties; and Republican and Democratic members of Congress should gladly unite in the good work.

When this is accomplished, it will only remain to apply a similar policy of reciprocal trade to all the States in Central and South America. And lo! the dream of our destiny will have been practically realized without the loss of a single drop of blood.—*N. Y. Jour. Commerce.*

Explosion of a Cannon Mould.

At the South Boston Iron Works on the 9th of July a remarkable explosion took place during the casting of a gigantic cannon. Fortunately no lives were lost.

For three weeks these works have been manufacturing guns for the United States Government. The order was for five cannons of the largest bore, and three of them had been made.

Early in the afternoon the process of casting was begun on the largest gun. Three furnaces, each containing forty tons of melted ore, furnished the metal. The spectators had just left the room, and the firemen were filling up the cavities caused by the cooling of the metal. The men were standing a short distance from the pit when the explosion occurred, sending a column of molten iron to the roof, a height of sixty feet, and scattering it in all directions. The men fled, and fortunately escaped. The building was set on fire, but only the roof was destroyed. The cause of the explosion is a mystery. The company will not lose over $6,000. The building, pit, and machinery were put in by the Government in 1881, and the pit was forty-one feet below the surface. The gun if perfected would have been a twelve-inch rifle bore breech loader, and of the Rodman pattern. It would have been 38 feet 6 inches long, and would have weighed 120 tons. It was 3 feet 7 inches across the muzzle, and 4 feet 9 inches across the breech.

Grinding by Machinery.

For some time past a machine has been at work in Sheffield which has effectually solved the problem whether grinding can be done by machinery. It is the invention of James Mitchell. Not only can the machine do the work of five or six men, but the quality of the grinding is said to be superior to that produced by hand labor. It is almost automatic in its action, and it does its work so easily and satisfactorily that a boy is sufficient to attend to it. The machine is altogether unlike what had been expected. There is no large revolving stone like those to be seen in grinding mills; but its place is taken by segments or blocks of stone, fixed by wedges and screws into the ribs of a hollow disk. These stone blocks are set with their faces toward the object or objects to be ground; and they are so fixed that they can readily be moved outward as the face begins to wear. When the machine is set in motion, the disk rapidly revolves at right angles to a bed or bedplate. To this bedplate the objects to be ground are secured. It has a backward and forward movement, and as it moves the articles secured to it are brought into contact with the stones on the face of the disk. The rapidity with which the machine does its work in comparison with the results of hand labor is very striking. But not only is it capable of grinding flat surfaces, and truing up edges; it grinds concave or convex, and bevels and angles equally well. It will thus be seen that the machine can be used upon a variety of objects.

Curious Properties of Coal-gas.

The following is an abstract from a lecture by Mr. Thomas Fletcher, recently delivered at Cheltenham, England:

"When we consider how long gas has been in common use, it is surprising how little is known concerning its use. Until within the last few years most people have been under the impression that it was merely a means of obtaining light, and even for this purpose it has been, and, I may say, still is, most wastefully used. The majority of the people seem to think that if they only burn a quantity of gas it matters very little how the gas is burned, or what burners are used. As an example, I often see ordinary sitting-rooms about the size of my own—*i. e.*, 15x20 ft.—lighted by three or four burners, each being most carefully inclosed with opal or ground-glass globes, which waste about half the light. My own sitting-room is lighted by one No. 8 Bray's burner, and I may safely say that few rooms are so well lighted. People are not generally aware that one large burner gives far more light than two separate burners, each consuming 4 feet per hour, and that one burner without shade is about as good as two with opal or ground-glass globes. Many people prefer the appearance of burners with glass globes, but they must bear in mind that this entails a much larger gas consumption for the same light, and also more heat and vitiated air in the rooms. There are burners made of two small ones joined at a certain angle, which are said by the makers to give a great increase of light for the same gas consumption. The fact is that, as I show you, two burners, each burning 4 feet per hour, give far more light when both flames are joined in one, but they give little, if any, more light than a single good burner burning 8 feet per hour, and the compound burners are extremely liable to cause black smoke when turned low. I show you the two arrangements side by side, and you will see the fact clearly without further proof, although, of course, my experiment is a rough one. The truth of what I tell you has been proved by photometer tests repeatedly. There is another point not generally known, that if a burner is placed at such an angle as to give a flat or saucer-shaped flame, the light is greatly increased, but this has a similar objection to the compound burner—it is liable to smoke if turned low. A great argument against the use of gas is the smoking of ceilings, etc., and curiously enough these complaints come strongest from those people who burn their gas carelessly under excessive pressure without control, and under such circumstances that smoke is almost impossible. The liability to true smoke occurs only in places such as open shops, where the flames are blown about very much, or in those places where first-rate burners are used under the best conditions—that is, just verging on the smoking point. The fact is that the supposed smoke is not smoke at all; the discoloration is gray or brown, not black, as it would be with smoke, and is, I think, caused only by the dust in the air being more or less burnt, caught in the ascending current of hot air, and thrown against the ceiling. When the gas is first lighted the ceiling is cold, and the water formed by the combustion of the gas condenses, forming a surface to which dust readily adheres, and if we use any burner, whether oil or gas, in one fixed position, the discoloration above it is exactly the same, depending entirely upon the power of the burners used. When the servant lights the gas on a dark morning and proceeds to clean up the fire-place and dust the room, she does practically all the smoking of the ceiling which takes place; once the dust settles, little discoloration occurs after. I cannot keep you here six months to prove this practically, as it really occurs; in fact, the dust in the air is so minute in quantity that it takes a long time to produce visible effect, but I have seen sufficient of the results with experimental burners to be practically certain that this is the only cause of the so-called smoking of ceilings. It can be prevented to a great extent by a shade of any kind over the burner. The reason why lamps do not cause this discoloration is that they are not always in the same place, and they are as a rule of much lower power than the gas-lights ordinarily used in the same room. Gas can be burned most efficiently for heating purposes without any flame or visible combustion; in fact, flame is only a sign of incomplete or imperfect combustion, and, looking forward to a possibly near future, I believe that all fuels, both solid and gaseous, will be burned for heating purposes without any flame. I will show you how deceptive appearances are by making an enormous flame, in which I am burning, probably, at the rate of 100 cubic feet of gas per hour. This flame is a delusion; like an empty bottle, it is all outside and of very little use. Passing through the thin film of flame on the outer surface it is quite cold inside, and this I will easily prove. If it were large enough, I should not have the slightest objection to walk into the middle of it and remain there; not being large enough for myself, I will protect the stem of this thermometer from the outer film of flame, and put the bulb inside. It will register about 120° Fahrenheit. I will replace the thermometer-bulb by a ball of tissue-paper, and you see it is unchanged. I will protect part of my hand from the outer film of flame, and pick the paper out with my bare fingers; and, lastly, will place a small paper of gunpowder in the center of the flame and let it remain there. Such a flame as this, notwithstanding its apparent fierceness and size, is of little use. If you place a cold vessel in it, it makes an abominable smell. It is a mixture of gas and air, but in incorrect proportions, owing to the faulty construction of the burner, and the mixture can only burn on the surface where it comes in contact with the external air. By increasing the air-supply to the correct proportion, as you see, the flame is reduced in size, becomes solid to the center, and explodes the gunpowder. Carrying on my experiment still further, I now use a different burner of a much smaller size, and use air under pressure from a small foot-blower—as the burner I have been using would, with an air-blast, require about 1,000 cubic feet of gas per hour to work it—and I wish to show you, as near as possible, the same quantity of gas being burned under different conditions. This burner you now see is only 2¾ inches across the surface, yet, with the assistance of a small blower, it may be made to burn perfectly up to 200 cubic feet or more per hour—sufficient to make steam for a two or three horse-power engine. You can judge of the heat of the flame by the iron wire I put in it, which you see burns almost like paper. Changing the burner once again, I use a large blowpipe, which gives a most intense flame; in fact, the advantage of a blowpipe consists in its burning as much gas as possible in an exceedingly small flame of great intensity. Now, if you will watch me carefully, I will direct the flame on this ball of fine scraps of wrought iron, a metal which is practically infusible in an ordinary furnace, and without turning off the gas I will pinch the gas-supply pipe so as to extinguish the flame. The gas is still there, burning as before, but burning entirely without flame, and, as you see, the iron melts and runs like water instantly. That there is no flame I will prove to you by putting a slip of paper before the blowpipe, which, as you see, is not burned nor discolored; that the gas is burning and has not been interfered with I will prove by stopping the blower, and allowing the gas to burn with a flame as at first. I have now taken you from a cold flame, into the center of which I put my fingers, to an intense heat without any flame, and, as you see, the heat increases as the flame reduces, until at its maximum the flame disappears altogether. The combustion of gases appears to be a succession of explosions, either so quick as to be silent to human ears, or so slow as to make, if continued, a musical sound. To enable you all to hear this I shall, as you will no doubt admit, pass the bounds of what may be considered classical music, but I will make these two burners speak in their own natural tones. If they are not charming as musical instruments they have the one great advantage that a little of it goes a very long way, and you will not desire that my musical performance shall be a long one. The quantity is amply compensated for by the quality, which is certainly not excelled by anything from a donkey to a fog-horn. Bear in mind that the application of gas to music is in its infancy, and there is certainly room for improvement in the future."

American Granulated Sugar.

Our English friends are again disturbed over the introduction of another American product into their dominions. It is not our machinery, hardware, butter, or cheese this time, but it is the introduction into the large English ports of American refined sugars that the British press calls the attention of their refiners to. We extract from an editorial in the *Grocer* (London) of June 14:

"At a time when the British refiners are sorely beset, if not overpowered, with foreign competition from beet sugar manufacturers on the Continent, they are exposed to another menace to their industrial well being by the energy with which their American rivals are now sending granulated sugar over to this country. For some years past there has been what is called a quiet, steady trade doing in the article at intervals, but without arresting much attention or assuming dimensions that were calculated to arouse any jealousy or fear as to its ultimate effects upon the refining industry here. Not only this; the prices at which sales have been made have often been as secret as the contents of a sealed letter of instructions between one military or naval station and another, though when quotations by the merest chance have oozed out, they have generally been found to agree pretty closely with the relative value known to have been current for similar descriptions of English, French, Dutch, or German refines.

"The American sugar refiners, as a rule, do not aim at turning out many specialties of production for the foreign markets, but confine their operations to the preparation of such kinds as are likely to command the greatest favor at certain periods. The Yankee refiners evidently do not believe in indiscriminate and haphazard competition in the same sense that French and other refined sugar producers do when the latter set their minds upon overrunning the British markets with a glut of inferior goods at random prices, regardless of prime cost—probably because the American conditions of manufacture and export are not exactly the same as those on the Continent, where the system of bounties flourishes in its full blown ugliness; and this modification and changeableness of their policy in supplying our markets accounts for the fits and starts with which sugar is shipped across the Atlantic from the United States.

"Sometimes the sugar the Americans send us takes the form of cubes; at others, that of powdered or granulated sorts; but they never supply us with baked or stoved kinds, nor anything in the shape of pieces or moist goods, more especially as the last mentioned sugars would woefully deteriorate on the voyage hither. They rather make wise selections of what qualities will find the readiest buyers and fetch the best prices. Their plans vary accordingly, and when an article ceases to pay they discontinue working it, or take up with another instead; and if neither of these courses satisfies them, they stop the outturn altogether. If we mistake not, the last time American sugar was sold in any quantity here was in 1879 and 1880, and what are styled 'cubes' were the favorite sugars then.

"This is not the least surprising when it is considered that the American products are derived exclusively from the sugar cane, while those from the Continental refineries, without exception, are manufactured (and that, by the bye, not without a little doctoring and chemical dressing) entirely from beet or mangold-wurzel, which is naturally deficient in both saccharine richness and sweetening power. Any persons accustomed to beet flavored productions are hardly aware of the difference that exists between those and sugars expressed from the cane, and once give them a fair chance of comparing the taste of one with the other, they would never leave cane to return to beet. Thus it is that American made sugars whenever they appear in the English markets nearly always meet with a good reception; and although it is the granulated sort, and not cubes, that is now offering in such large quantities, the preference it gains over other competing qualities is none the less striking and significant. The low price at which it can be bought is likewise greatly in its favor, and ought to insure for it a continued ready sale. As noted, the quotation in April last was 25s. 6d., landed; but through the severe and prolonged depression that has since prevailed, the selling value, in sympathy with that for sugar in general, has recently dropped to 19s. 6d. and 19s. per cwt., cost, freight, and insurance, in barrels of three cwt. each, and the article is passing more freely into consumption than before. The arrivals of American sugar into the United Kingdom this year have been about double those in 1883, and the greater part of the supply goes into Liverpool and the Clyde ports, as being in most direct communication with New York, Boston, and the north of America, from whence it is shipped."

Trial of the Kunstadter Screw.

The experiments with the United States steamer Nina, to which the Kunstadter screw has been attached, were completed July 9, at Newport, R. I., by two trials that proved to Capt. F. McGrau, the President, and all the other members of the Naval Board, the value of the invention. The first trial was from full speed ahead to full speed astern, with helm hard a-starboard to change direction of ship's head eight points. When the signal was given to reverse, the time occupied in getting at full speed astern was 2 minutes 59½ seconds, against 6 minutes 5 seconds without the Kunstadter screw. The second trial was from full speed ahead to full speed astern, with helm hard-a-port to change the direction of ship's head eight points. The time occupied with the screw was 4 minutes 43 seconds; without the screw, 5 minutes 48 seconds. The Board will report to the Secretary of the Navy that the vessel can be more easily steered and maneuvered with the screw than with the ordinary apparatus, and that the tendency will be to decrease the number of collisions.

The Kunstadter screw is an English invention, patented here in 1879. There is a main screw, shaft, and rudder of the usual construction. The rear extremity of the main shaft is elongated, and extends through and abaft the rudder, said elongation at the rudder hinge being swivel jointed to the main shaft. The extremity of the elongation back of the rudder is provided with a small propeller. When the main shaft revolves both propellers revolve, and any lateral movement given to the rudder also laterally moves the small propeller, which thus powerfully assists in turning the ship.

Heart Beats.

Dr. N. B. Richardson, of London, the noted physician, says he was recently able to convey a considerable amount of conviction to an intelligent scholar by a simple experiment. The scholar was singing the praises of the "ruddy bumper," and saying he could not get through the day without it, when Dr. Richardson said to him:

"Will you be good enough to feel my pulse as I stand here?"

He did so. I said, "Count it carefully; what does it say?"

"Your pulse says seventy-four."

I then sat down in a chair and asked him to count it again. He did so, and said, "Your pulse has gone down to seventy."

I then lay down on the lounge, and said:

"Will you take it again?"

He replied, "Why, it is only sixty-four; what an extraordinary thing!"

I then said, "When you lie down at night, that is the way nature gives your heart rest. You know nothing about it, but that beating organ is resting to that extent; and if you reckon it up it is a great deal of rest, because in lying down the heart is doing ten strokes less a minute. Multiply that by 60, and it is 600; multiply it by 8 hours, and within a fraction it is 5,000 strokes different; and as the heart is throwing 6 ounces of blood at every stroke, it makes a difference of 30,000 ounces of lifting during the night.

"When I lie down at night without any alcohol, that is the rest my heart gets. But when you take your wine or grog you do not allow that rest, for the influence of alcohol is to increase the number of strokes, and instead of getting this rest you put on something like 15,000 extra strokes, and the result is you rise up very seedy and unfit for the next day's work till you have taken a little more of the 'ruddy bumper,' which you say is the soul of man below."

WELL PIPE CUTTER.

In the lower end of the forked piece is pivoted a sharp edged cutting roller, the pintle of which passes through inclined slots in the shanks of a forked piece held between the shanks of the upper piece. (This construction is plainly shown in Fig. 2, in which the front fork of the upper piece is removed.) Projecting upward from the top of the lower piece is a screw passing through an internally threaded sleeve held to turn in a ring formed on the upper end of the upper forked piece. On the upper end of the sleeve is screwed and fastened a swivel piece, on whose upper end is a screw for attaching the working rod. In the edge of the lower forked piece are pivoted anti-friction rollers, and to its lower end two bow springs are fastened.

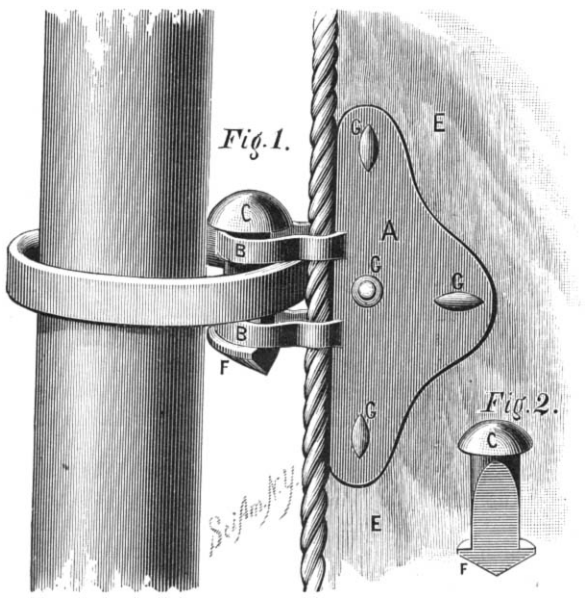
The instrument is forced down in the well pipe, the springs preventing the loose part from turning. If the swivel part is turned, the sleeve is turned with it and the lower forked piece is moved upward, thereby causing the cutting roller to project from the edge of the other part. The device is then worked up and down, causing the roller to cut a vertical slot in the pipe; by turning the device more or less, the slot may be made of any desired width. After the slot has been cut the swivel part is turned in the opposite direction, when the roller is drawn in between the shanks.

This invention has been patented by Mr. A. W. Benson, of San Bernardino, Cal.

SAIL CLAMP.

A clip formed of two end plates, A, connected by two loops, B, is attached to the edge of the sail by rivets, G, or in any other suitable manner, with the edges of the plates inside of the leech rope. The edges of the clip next to the rope are bent outward to fit closely against the rope, thereby distributing the strain over a large surface. The loops are separated a sufficient distance to receive between them a mast hoop, which touches the rope and is retained in place by a pin, C, upon one end of which is the head, C, and upon the other end a conical head, F. A portion of one side of the pin and the conical head is cut away (Fig. 2), giving the pin a wedge shape. The pin passes through the loops, and binds the hoop against the leech rope, and the conical head engages the lower loop and prevents the pin from accidentally escaping.

Although this invention, which was recently patented by Mr. G. W. Idner is applicable to sails of all vessels, it is designed more particularly for yachts and light sailing



IDNER'S SAIL CLAMP.

vessels, in which it is often necessary to quickly shift the sails, and with it the sail will sit better and lie flat to the wind. Additional particulars regarding this invention may be obtained by addressing Messrs. Idner & Rike, P. O. box 19, Thomasville, Ga.

FOR a waterproof paper which will shine in the dark, the *Papier Zeitung* gives the following mixture: Forty parts paper stock, ten parts of phosphorescent powder, ten parts water, one part gelatine, and one part bichromate of potash.

The Obstruction of Water Pipes.

At a recent meeting of the Academy of Natural Sciences in Philadelphia, the obstruction of water pipes was the subject discussed. Mr. Ed. Potts, a well known authority on sponges, had examined water pipes that had become useless from some obstruction, in order that he might ascertain whether the obstruction was due to sponge growth. Mr. Potts announced that he could find no sponge growth in the obstructed water pipes, the blocking of which was argillaceous, with iron impregnation. At the same time Mr. Potts stated that in all water pipes he had examined there was a growth of sponge, and that the sponge was often strongly impregnated with iron.

To the writer it appears probable that the obstruction of the water pipes takes place in the following way: The sponge statoblasts carried by the running water attach themselves to asperities of the interior of the pipes, and there, well supplied with food by the current, soon develop into a flourishing growth of sponge. The sponge substance, full, like all sponges, of small openings through which water enters, and large ones from which it is expelled, acts as a filter to remove from the water the particles of sand and mud held in suspension, while at the same time the iron in the water probably retards the growth of the spicules which form the sponge skeleton, and thus endangers the stability of the sponge. This goes on until the sediment accumulated by the living sponges becomes too much for their fragile structure, and the result is that mud and sponge are torn away in masses which, finally accumulating in the smaller pipes, obstruct them completely.

By the time this occurs the only evidence of sponge structure likely to be found would be, not spicules, themselves microscopic objects, but the still more minute fragments of spicules which had never been able, according to the observations made, to properly develop. At certain seasons of the year the quantity of earthy material in the water is much larger than at others, and the obstruction would therefore take place more rapidly. Although the sponge growth may thus be the cause of the obstruction of small pipes, its action while growing would be to remove deleterious organic matter, both by actually feeding upon it and by mechanically filtering it out.

To Clean Marble.

A person who has tried many ways for accomplishing the above object thinks the following plan, which he came across in some newspaper, quite the best: Brush the dust off with a piece of chamois, then apply with a brush a good coat of gum arabic, about the consistency of thick mucilage; expose it to the sun or wind to dry. In a short time it will peel off; wash it with clean water and a clean cloth. If the first application does not have the desired effect, it should be tried again. Another method is to rub the marble with the following solution: One-quarter of a pound of soft soap, one-quarter of a pound of whiting, and one ounce of soda and a piece of stone blue the size of a walnut; rub it over the marble with a piece of flannel, and leave it on for twenty-four hours; then wash it off with clean water, and polish the marble with a piece of flannel or an old piece of felt, or take two parts of common soda, one part of pumice stone, and one part of finely powdered chalk, sift it through a fine sieve, and mix it with water, then rub it well over the marble, then wash the marble over with soap and water.

To take stains out of white marble, take one ounce of oxgall, one gill of lye, one and a half tablespoonfuls of turpentine; mix and make into a paste with pipe clay; put on the paste over the stain, and let it remain for several days. To remove oil stains, apply common clay saturated with benzine. If the grease has remained in long, the polish will be injured; but the stain will be removed. Iron mould or ink spots may be taken out in the following manner: Take half an ounce of butter of antimony, and one ounce of oxalic acid, and dissolve them in one pint of rain water; add enough flour to bring the mixture to a proper consistency. Lay it evenly on the stained part with a brush, and, after it has remained for a few days, wash it off, and repeat the process, if the stain be not wholly removed.

WAGON END GATE.

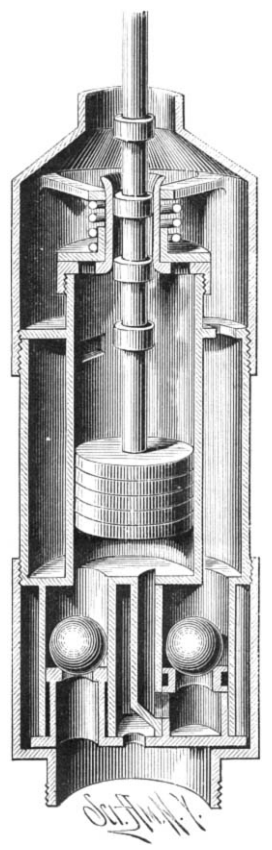
The end gate consists of two similar parts, A, provided with cleats and connected by hinges placed upon the inside. The inner cleat of each half has a small bracket placed in such a position as to be engaged by the hooked rod, B, which extends across the wagon box and is permanently linked at one end to an eye bolt. The hooked end of the rod engages an eye bolt projecting through the opposite side of the box. Each eye bolt is provided with hand nuts, C, by means of which the sides of the box can be drawn tightly against the ends of the end gate, which is prevented from lifting or opening outward by the rod. The ends of the gate are received between cleats in the usual way. By loosening one of the hand nuts and removing the hooked end of the rod, the hinges yield and the end board opens outward. The rod cannot become misplaced or lost, as it is retained by the other eye bolt. If the load cannot be conveniently removed from the end of the box without removing the eye bolts, they may be easily taken out after the nuts have been unscrewed. To facilitate the outward movement of the end board, the inner corners of its outer end are rounded, as shown clearly in Fig. 2.

This invention has been recently patented by Mr. David B. Keagy, of Yankton, D. T., who will furnish further particulars.

DOUBLE ACTING PUMP.

The pump herewith illustrated has been patented by Mr. James McGwin, of Fulton, Missouri, and is constructed with an inner and outer cylinder. The piston, working in the inner cylinder, is attached to a piston rod provided with a series of packing collars fitting in a tube which is flared slightly at top and bottom. The top of the cylinder is provided with a series of apertures arranged in a circle. An annular valve plate rests on the top, between which and a cross piece held in the upper part of the cap, which is contracted toward its upper end, and provided with a neck to which the lower end of the stand pipe is secured, is a spring.

Surrounding this cylinder is a larger one on which the cap is screwed. An opening forms a communication between the upper part of the inner cylinder and the channel between the two cylinders. Two vertical radial partitions form channels between the cylinders, and at the upper end of one is an opening. Secured to the bottoms of the cylinders are three tubes, each of which contains a ball valve.

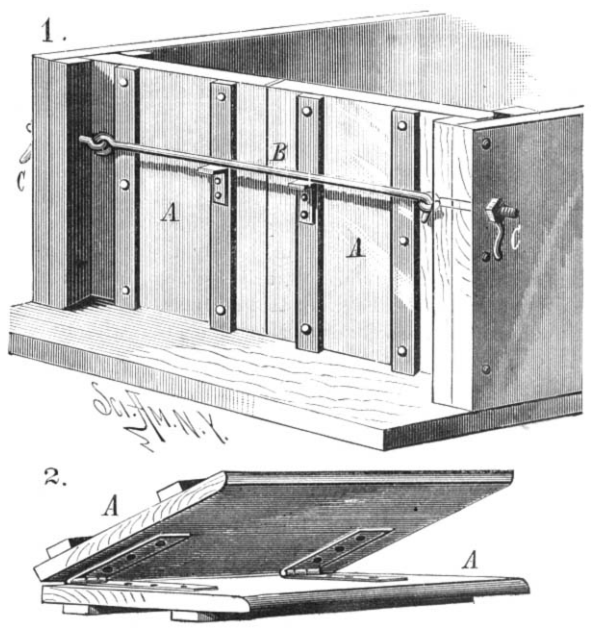


The upper end of the tube shown at the right of the engraving communicates with the bottom of the channel; the second tube communicates with the inner cylinder; and the third one with the other channel. A duct leads from the inner cylinder to the bottom of the first tube. A cap, open at the bottom, is screwed to the lower end of the outer cylinder. If desired, the pump can be inserted in the tube of an artesian well, and in that case no stand pipe need be secured to the top.

As the piston ascends, water is drawn into the bottom of the inner cylinder through the second valve. The water above the piston is forced out through the apertures into the cap, the valve being raised by the pressure. When the piston descends, the water is drawn into the upper part of the cylinder, through the third tube (not shown in drawing), the channel, and the opening. The water below the piston is forced out through the duct, the right tube, and channel into the cap. The water rises from the cap into the stand pipe attached to the neck.

Cornell's Mummy.

Cornell University has lately received what must after all be regarded as the most wonderful of the products of the land of the Pyramids—a mummy. It was procured from the necropolis in Upper Egypt about a year ago. From the hieroglyphic inscriptions of this mummy it appears that the name was Reupi, and that he belonged to the Twenty-third Dynasty. The body was, therefore, laid away eight hundred years before Christ, or nearly three thousand years ago. Prof. Tyler, in connection with the reception of the mummy, called attention to these facts. Reupi lived before the first Olympiad, nearly fifty years before the legendary



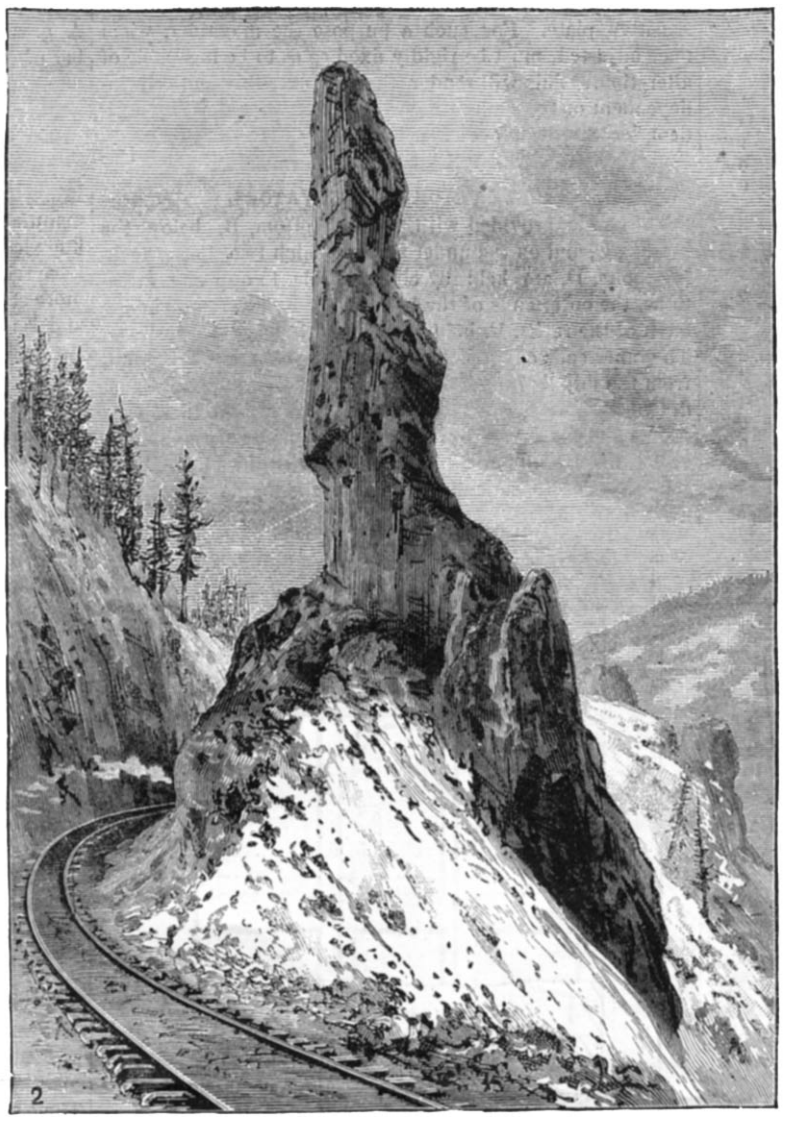
KEAGY'S WAGON END GATE.

founding of Rome. He was contemporary with the founding of Carthage, two hundred years before Cyrus, three hundred years before Confucius, and seven hundred and fifty years before Julius Cæsar invaded Britain, four hundred years after the Trojan War, three hundred years before the battle of Marathon, or in Jewish chronology, five hundred years after the Exodus, and only one hundred and seventy-five years after Solomon. He was a contemporary of Elijah and Ahab.—*N. Y. Observer.*

PHANTOM CURVE.—DENVER AND RIO GRANDE RAILWAY.

The romantic scenery of Colorado and New Mexico, traversed by this line of railway, which runs southward from Denver, along the base of the Rocky Mountains, finding a Pass over these to the foot of the Sierra de San Juan, thence descending from Taos to Santa Fe and the Rio Grande, has been celebrated by travelers. In the neighborhood of Denver, or a few hours' journey from that city to the south, is some of the finest mountain scenery. At the "Garden of the Gods," visitors are astonished to find themselves in the midst of a hundred towering piles of white and red sandstone, moulded into a variety of fantastic shapes, but mostly rising to spires higher than any cathedral that ever was built. The president of the railway company, General Palmer, has a villa in Glen Eyrie, a secluded recess walled in by cliffs of imposing height.

Monument Park, at no great distance, is a place of the same natural character, where the multitude of rock pillars and rock pyramids resemble the crowded monuments of a vast cemetery, and have a very curious effect. The San Juan section of this line, on the other side of the mountain range, presents terrific gorges and singular rock formations.



PHANTOM CURVE.—DENVER AND RIO GRANDE R.R.

AN EXTRAORDINARY BOILER EXPLOSION AT ORLEANS, FRANCE.

On Monday, April 28, the city of Orleans was set in a flurry by a serious accident that occurred under curious circumstances, and the consequences of which might have been appalling.

Toward seven o clock in the morning, a steam engine, mounted on a cart and belonging to Mr. G. Colas, a manure farmer, had stopped in Illiers Street in front of the house of Mr. Lebordais-Grenet, a grocer who lives in Porte-Saint-Jean Street, but whose front entrance is in the former street. The gang of workmen who were employed to operate the apparatus were just getting ready to go to work, when suddenly a fearful explosion was heard. The generator, which stood vertically at the rear of the cart, breaking the bolts that held it firmly fixed to the iron frame of the vehicle, shot up all in one piece, like a sky rocket, parallel with the front of the house before which the vehicle was standing. Reaching the roof (a distance of about ten meters from the ground), the enormous and heavy mass came in contact with the cornice, and, although it but slightly grazed it, the shock was sufficient to cause it to deviate from its course, describe a curve over the block of houses between Illiers and Porte-Saint-Jean Streets, and fall in a blind alley off the latter, at thirty-five meters to the south of its starting point.

In its fall, the immense projectile caught the gutter and cornice of a house numbered 45, inhabited by Commander Coutant, and fell upon the shafts of a dust cart whose driver had left it standing in the alley in order to lead his horse to a farrier's in the neighborhood. It makes one shudder to think of the massacre this explosion might have occasioned, without speaking of the material havoc that it might have caused. It will suffice to say that if Mr. Lebordais's store had been struck, a fire might have at once broken out in his petroleum reservoirs. In fact, at the moment of the accident, a regular storm of fiery cinders, bolts, and various debris swept Illiers Street and the ground floors of the neighboring houses. Breaking the window panes, these fragments entered a fruit store in which there were three persons, and also started a fire in the house of Mr. Coudiere, former Municipal Counselor of the city of Orleans.

Two young children who were seated at the window of the first story of house No. 126 Illiers Street merely received a fright, as the projectiles did not rise as far as to them. As for the five workmen in Mr. Colas's employ, four of them were slightly harmed or burned, and one was severely wounded. The cart, which was violently overturned upon the ground, carried along in its fall the horse that was harnessed to it, and, strange to say, neither was harmed.

The generator, less its firebox and smoke stack, fell, as we have said, upon the pavement of Saint-Jean Alley. Its tubes and its jacket were as flattened and crushed as if they had been made of lead, while the pressure gauge and the *glass tube of the water level* were intact. The different parts of the firebox had been scattered in all directions, and the smoke stack had fallen at about seventy meters from the place of explosion, and in a northeast direction.

These facts seem so improbable, as a whole and in detail, that we have thought it indispensable to call upon photography to preserve a souvenir thereof, in order that we might back up with material proofs the faithful account of it that we have just given.—*Leon Dumuys, in La Nature.*

BOILER EXPLOSION AT ORLEANS, FRANCE.

Extension of Cotton Spinning in England.

Undoubtedly the manufacture of cotton goods is now being conducted on very close margins for profits, as is the case with most other staple products at the present time. Those who think, however, that England is losing any of its old time prominence in this branch of business, would do well to look at the facts before making rash conclusions. The spinners there plan new mills and extensions from September to April, as the general rule, that the building operations may be conducted in the more favorable summer months. Figuring on the extensions of the cotton manufacturing plant for the present season, after this plan, the *Textile Manufacturer* places the increase, with the new companies formed, at one and a half million spindles in Lancashire, Cheshire, and Yorkshire. This is a larger number of cotton spindles than Lowell now has, or any other city in the United States except Fall River.

On the night of July 7, the steam tug H. C. Coleman exploded its boilers at Elliott's Landing, on the Missouri River, seven miles from Booneville, and all the crew, three white men and four negroes, excepting Captain Thompson, were killed. The boat was torn to pieces and the pilot house was blown two hundred yards away.

Production of Colored Lights.

Professor Dewar, in a recent lecture at the Royal Institution on "Flame and Oxidation," exhibited apparatus for producing colored flames. Hydrogen burns with an almost non-luminous and colorless flame, its tinge of yellow being chiefly due to impurities in itself and in the air, in the shape of floating particles of soda salts; but this tinge is not deep enough to do harm in the application of his apparatus to the purposes just suggested. The apparatus consists of a kind of "spray producer," by which the gas is first charged with particles of any desired salt in solution, and then conducted to the burner.

To obtain a steady flame a steady blast of gas is necessary. At the Royal Institution hydrogen, compressed in an iron receptacle, is used; but any other arrangement which gives pressure enough will answer the same purpose.

Professor Dewar charged the hydrogen gas with solution of chlorochromic acid. This gave a brilliant white flame, rich in rays which act on photographic films. It also gave off a white smoke, which, on being collected on a white plate, was seen to really consist of green particles of oxide of chromium; indeed, the plate was colored a bright green. By means of a salt of sodium he gave a yellow color to the flame, and to himself a ghastly appearance. In short, the apparatus affords a ready means of keeping up a steady and large colored flame when the operator has a steady supply of hydrogen at sufficient pressure. It is better than the old-fashioned plan of coloring a spirit flame by salts dissolved in the alcohol, because many salts will scarcely dissolve therein at all; and when they do, and are not volatile, they often clog the wick, and do not find their way in any great quantity into the flame. The construction of the spray-producing part of Professor Dewar's apparatus is a very simple matter of glass blowing.

In the course of some experiments on increasing the luminosity of flames, Professor Dewar proved that increasing the quantity of air would, under certain conditions, increase instead of decrease the light of a Bunsen's flame. He directed a jet of air into a Bunsen's flame, and, when a particular steadiness and pressure of air blast had been reached, the air colored the flame green where it passed through it. He also exhibited Frankland's experiment of burning an oxyhydrogen flame under pressure, and its luminosity increased with the pressure. From this Frankland argued that the luminosity of flame does not necessarily depend upon particles of solid matter liberated in the flame, for in this experiment no solid matter is present. Professor Dewar said that there is some truth in Frankland's hypothesis that the luminosity of flames is due to highly condensed gases, and a great deal of truth in Davy's original hypothesis that the luminosity is due to liberated particles of carbon or other solid matter in the majority of cases. He next proved that the luminosity of the electric spark increases under extra pressure of air, but said that the result might be explained by a variety of hypotheses, so that its real cause is difficult to unravel.

The lecturer further stated that some hydrocarbon compounds enter, like paraffine, into combination with other substances with difficulty; others, like olefiant gas, acetylene, and naphthaline, are easily decomposed, or easily enter into new combinations. In illustration of this he experimentally proved that a small quantity of bromine will quickly absorb a large volume of olefiant gas, and also that bromine readily unites with naphthaline, giving off vapor of hydrobromic acid in the act.

Professor Dewar remarked that in scientific research it is sometimes necessary to use a flame free from superheated steam. Such a flame can be most readily obtained by burning a jet of chlorine and hydrogen, mixed near the nozzle of the burner, for safety, and care being taken to carry off the hydrochloric acid gas, which is the product of the combustion.

Red Toning.

The following is the formula employed successfully by M. Balagny for the red toning so much in vogue at present. Dissolve 1 gramme of chloride of gold in a liter of distilled water, then add 200 c. c. of a filtered solution, made at boiling point, of 30 grammes of borax and a liter of water. The toning bath is brought up to the temperature of 70° or 80° Centigrade, and then the prints are plunged into it for thirty or forty seconds only.

They are afterward fixed in hypo containing one to two per cent of ammonia.

A Floral Time Table.

It is a most interesting fact that certain flowers open and close their blossoms at least once every twenty-four hours, although the cause of this action is as yet but imperfectly known. In some cases it may depend on heat, in others on light being present in sufficient force. The fact has long been known. It was known to Linnæus, and some of the early gardeners mention floral clocks and dials among the quaint conceits offered to the readers of their books. Here is a list of plants which open at different hours during the day. The first column of figures gives the time of opening in the morning, and the second column shows the time of closing.

	H.	M.	H.	M.
Goat's beard—Tragopogon luteum	3	5	9	10
Late flowering dandelion—Leontodon serotinum	4	0	12	1
Hawkweed—Picris echioides	4	5	12	0
Alpine hawk's beard—Crepis alpina	4	5	12	0
Wild succory—Cichorium intybus	4	5	8	9
Naked stalked poppy—Papaver nudicaule	5	0	7	0
Copper colored day lily—Hemerocallis fulva	5	0	7	8
Smooth sow thistle—Sonchus lævigatus	5	0	11	12
Field bind weed—Convolvulus arvensis	5	6	4	5
Common nipple wort—Lapsana communis	5	6	10	0
Spotted cat's ear—Hypochæris maculata	6	7	4	5
White water lily—Nymphæa alba	7	0	5	0
Garden lettuce—Lactuca sativa	7	0	10	0
African marigold—Tagetes erecta	7	0	3	4
Mouse ear hawkweed—Hieracium pilosella	8	0	2	0
Proliferous pink—Dianthus proliferus	8	0	1	0
Field marigold—Calendula arvensis	9	3	3	0
Purple sandwort—Arenaria purpurea	9	10	2	3
Creeping mallow—Malva caroliniana	9	10	12	1
Chickweed—Stellaria media	9	10	9	10

—*The Garden.*

Focusing Screens for the Camera.

Says the *British Journal of Photography:* When glass is coated with a thin solution of starch and allowed to become dry, a focusing surface is secured which possesses certain advantages over all others. It possesses a very fine grain—one which, better than any other, is adapted for arresting the rays from the lens under circumstances conducive to the examination of the image either by a single powerful magnifying glass or by the compound tube. The objection to the employment of a single or simple magnifier, even if it be composed of a doublet or triplet, is this: that when used in conjunction with a plain glass focusing screen there is a certain degree of latitude in the determination of the precise plane upon which the virtual image is projected—a latitude that does not exist when the rays are arrested by any image-receiving surface on the one hand, or, as already explained, by any polished surface on the other, when used in conjunction with a compound magnifier.

An ethereal solution of wax has sometimes been recommended as a coating upon which to receive an image. In such experiments as we have made with this substance the result, although exceedingly pleasing when employed as a backing for a transparency, is not successful when used as a focusing screen. Much better is a film of collodion modified in its physical structure by the admixture with it of an alcoholic solution of lac or the other gum resins which form the solid constituents of a good negative varnish. It is, doubtless, known to many of our readers that if collodion and negative varnish be mixed in certain proportions—the precise nature of which could not be stated unless the exact constituents of each were known—a varnish results which, when applied to a glass plate, dries with an appearance possessing singular beauty. Although both constituents are in themselves transparent, and give transparent films when used separately, yet when mixed the film given by their union is neither opaque nor transparent, but it possesses a remarkably beautiful opalescence.

This, although pleasing and useful as a backing for transparencies, is still of too purely an opalescent character to render it useful for receiving or arresting an image. It gives a surface too nearly conforming to that of opal glass to be of any utility as a focusing screen. This also applies in some measure, although not to such an extent, to the employment of a bromo-iodized, collodionized plate, which, having been immersed in a silver bath, is afterward charged with atoms of reduced silver through the intervention of a developing solution, these silver particles being exceedingly fine. In this category, too, may fittingly be included emulsions composed of such amorphous salts as sulphate of barytes suspended in either collodion or gelatine.

We may here observe that this last named preparation forms an admirable backing for transparencies, especially for those which are intended to be viewed through powerful magnifying glasses. The best way of forming the barium sulphate is by adding a little sulphate of soda to a solution of gelatine, and afterward a solution of chloride of barium. If this be done well, with constant agitation, the resulting sulphate of barytes is very fine and evenly distributed throughout the entire substance of the gelatine.

If, by accident, a focusing screen has been broken when the photographer is at a distance from any point of supply, the best substitute he can adopt is starch, which, happily, is procurable everywhere. To apply this substance to plain glass all that is requisite is to level the plate, and, having previously boiled and strained the starch, to pour it upon the glass, allowing it to remain quite level until by the evaporation of the water the film becomes hard and dry.

There are some photographers who adjust the subject to be photographed by sights placed on the top of the camera. This is an excellent system, especially when photographing at a distance from home. We have no hesitation in saying that the cameras of every traveler should have such sights affixed to them in case of accident to the ground glass.

Further: to permit of sharp focusing when such accident happens, it would be well to have provided a small but rigid strip of wood capable of being laid across the frame of the focusing screen, and carrying in its center a magnifier adjusted in such a manner as to enable a sharp image to be received in air when there is no ground glass at all to intercept it. This air image must, of course, be made to correspond in position with that which falls upon the surface of the sensitive plate. For such a purpose the magnifier, when once adjusted, must be rigidly fixed so as to be incapable of alteration. This will render the photographer entirely independent of the ground focusing screen should it by accident become destroyed.

SAFETY CATCH FOR ELEVATORS.

The car is provided with a false bottom, B, below the bottom, C, and on the under side of which two sliding locking bolts, D, are held by clips to slide in opposite directions, the outer ends of the bolts being beveled to fit in the teeth of the racks, F, held on the upright guide posts, G. The inner ends of the bolts are connected by a toggle joint, from the middle hinge of which a weight is suspended that draws the bolts toward each other. On the bottom of each bolt is a check lug, *a*, to limit the movements of the bolts in either direction by coming in contact with the clips, E. A rope fastened to the middle hinge of the toggle passes over

Fig. 1.

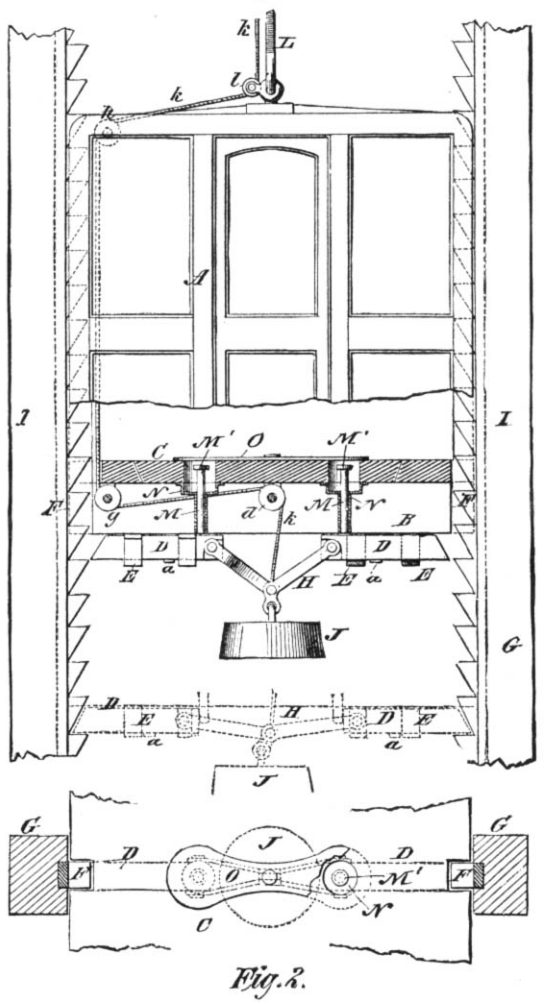


Fig. 2.

WEEKS' SAFETY CATCH FOR ELEVATORS.

a pulley, *d*, under the pulley, *g*, over the pulley, *h*, and under the pulley, *l*, on the middle of the top of the car. This rope is wound on the same drum with the hoisting cable, L, or on another drum. Two vertical locking pins, M, held in casings, N, project downward from the bottom, C; they are formed with the heads, M', on the upper ends, and rest on the inner ends of the bolts. The aperture leading to the casing and pins is covered by the plate, O. The weight of the block is greater than that of the bolts and the safety rope, so as to keep the bolts withdrawn.

If the hoisting cable break, all the strain will be on the safety rope, *k*, which would pull the middle of the toggle upward, thereby forcing the bolts outward and engaging their outer ends with the teeth of the rack, thereby locking the car in place. As the bolts are pushed outward their inner ends pass from under the locking pins, M, which drop down behind the inner ends to prevent the weight, J, from drawing them toward each other in case the safety rope should also break. By turning the plate, O, access may be had to the locking pins. Although the device operates automatically, it can also be worked by a person in the car pulling the safety rope. Fig. 2 is a sectional plan view through I I. If desired, the bolts can be arranged on the under side of the top of the car, and a spring can be used in place of the weight for shifting the bolts.

This invention has been patented by Mr. Frank A. Weeks, of Enniskillen, Ontario, Canada.

ORANGE PEEL is now said to be collected, dried in ovens, and sold for kindling fires. It burns readily and with great fierceness, and is safer than kerosene.

System in Shop Management.

An article under the above heading from the *Iron Trade Review* contains suggestions which it seems to us may be advantageously adopted into many large establishments other than those devoted to manufacturing.

Any changes may be made in the rules to render them better adapted for special localities, or modified to meet the requirements of some peculiar kind of business; but the rules seem reasonable, and the employe does not seem to have any good cause to complain of its requirements. A great many establishments who employ a large number of persons would derive great benefit by the introduction of a system similar to that given below into their works.

It is an encouraging sign of sound business conservatism, says the *Review*, that more attention has been paid of late to the matter of systematizing the work and accounts of our manufacturing establishments than ever before. Within our knowledge several of the largest concerns in the country have recently remodeled their system of accounts to conform more strictly with the economical necessities of the times; and it is no reflection on their business sagacity, but quite the contrary, that the heads of our leading manufactories are each year paying more and more attention to the small economies. We are aware that too much system is often worse than little or no system, but it is undeniable, at the same time, that just in proportion as the various lines of work of a great establishment are drawn to one center, and the record of work done and expenditures made condensed to a few words in few books, just so is that establishment enabled to pay dividends in good times and to weather through hard times when other concerns are floundering about and going under.

For the purpose of illustrating what may be done in this line, we refer briefly to a system adopted recently, after extensive correspondence and investigation, by one of the leading manufacturing establishments of Ohio. Succinctly stated, this system provides for a perfect record of each man's time and work, kept by himself and approved by the foreman of his department. Upon going to work in the morning each man receives a blank something like this:

....Department.

Report of .... 18....

LOT. Foreman to fill in.	No. Pieces.	Name of Piece.	Class of Work.	Finished.	No. HOURS. Day Work	No. HOURS. Piece Work	RATE. Day Work	RATE. Piece Work	Amount.

If a man come in late, he is given a similar blank but printed on paper of a distinctive color, with an additional space in which to mark the number of minutes or hours tardy. The effect of this has been to materially lessen the cases of tardiness—the men don't like to get the colored blanks. On the back of these blanks are printed the following rules:

WORKING HOURS.

These shall be such as may be designated from time to time. No extra time will be credited except by special agreement.

The blowing of the whistle will be the signal for commencing and quitting work.

All employes will be required to be present before, and begin work as soon as signal is given.

Should it be necessary to leave work before quitting time, the case must be laid before the foreman in charge and his consent obtained.

Necessity will alone excuse absence from place during working hours; other absence from post, without special agreement with foreman, will be sufficient cause for discharge.

Piece workmen are required to work the same hours as day workmen, unless especially excused by foreman in charge.

FOREMEN.

Foremen are required to observe these rules, and secure from the men under their charge proper compliance.

They will in all cases report to the superintendent or assistant any necessary absence.

They should be on hand at least five minutes in advance of signal for commencing work.

WATCHMEN.

The night watch must report for duty at 5:50 P.M., from May to October; and at 4:50 P.M. from October to May; at 4:50 P.M. Saturdays, Sundays, and holidays throughout the year, and must remain on duty till relieved.

The day watch must relieve the night watch at 6:30 A.M., and must remain on duty until in turn relieved.

ENGINEER.

The engineer must see that his fires and engine are in proper condition, must start his engine at least two minutes before time for commencing work, and run for two minutes after blowing whistle.

STRICTLY PROHIBITED.

Conversation among employes and the reading of books and papers during working hours is strictly forbidden.

Smoking or the lighting of cigars or pipes in the shops is strictly forbidden, except that during the noon hour it will be allowed in the foundry, blacksmith shop, and boiler shop, and nowhere else.

ABSENCE FROM WORK.

Should it become necessary for workmen to absent themselves from the shop for one or more days at a time, proper notice, with reason therefor, should be given to the foreman in charge.

Twenty-four hours' absence, without notice, will be sufficient cause for assigning others to positions thus made vacant.

The advantages of this system of time keeping are manifold. Before, the time was kept by the foreman, and there was no way of checking in case of dispute; now each man keeps his own time, subject to the approval of the foreman. Formerly the office had to keep an open account with each man; now the balances are made up each day. Heretofore there was no satisfactory method of getting at the actual cost of each piece of work; now it can be obtained without trouble. There was some objection by the men to the system at first, but after the adjustment of a few details, such as allowing them to take the company's time for filling out the blanks, all readily acquiesced in the new order of things, and matters are now running smoothly all around.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Eastern District of Pennsylvania.

SEWING MACHINE COMPANY *vs.* FRAME.—PATENT CUTTING AND TRIMMING ATTACHMENT FOR SEWING MACHINES.

Butler, J.:

A change made in an old device which, though simple, is effective, and produces a new and useful result, held to involve the exercise of invention.

The correction of a patent by means of a reissue where invalid or inoperative for want of a full and clear description of the invention is proper.

Where there is a doubt as to whether the description in a patent will be misunderstood, the judgment of the Patent Office as to the necessity of a reissue is entitled to great weight.

A structural difference in form and size does not avoid infringement if the same work is done by substantially the same means.

The manner of using it does not characterize a machine. This is effected by its structure and capabilities.

Carbonated Beverages.

The Board of Health of Brooklyn, N. Y., having found that water from some of the many badly contaminated wells of that city was being used in the making of carbonated water for the supply of soda fountains, siphons, etc., an inquiry has been set on foot relative to the possible danger to health from this source in New York city. As the firm of John Matthews supplies over three thousand such fountains in New York regularly, they anticipated such inquiry by inviting Dr. Edson, of the New York Health Board, to make a thorough inspection of their large establishment, not only to examine the water used, but also the processes and materials employed in making sirups, and the construction of their fountains and sirup holders, to prove that there was no possibility of metallic poisoning in the use of their apparatus. All the water they use is the city Croton, but this is thoroughly filtered in a large double apparatus by passing it through sand, charcoal, and gravel. The firm expended some $8,000 in putting down a well some 800 feet, but the water obtained therefrom was so impregnated with iron and sulphur as to be unavailable, and the well was filled up without ever being used. The sirup holders in their soda fountains are of glass, and the fountains themselves are of steel, but have a complete water and gas tight lining of pure block tin, put in by a process originated by the house. The firm use none of the old style copper fountains, which, in connection with the soda water as well as the faucets for the sirups, have undoubtedly caused a great deal of mineral poisoning. They annually receive and cut up many tons of such material for use as old copper, substituting therefor their own improved apparatus. The brass and copper fixtures they are thus receiving daily and consigning to the waste heap almost invariably have large deposits of verdigris, especially about the discharge openings of the multiple cocks for sirup holders. Could some of the old soda water drinkers see the condition of the inside of these fountains and their fixtures, the fine finish and the silver plating on their outsides would not much diminish their alarm. A representative of the SCIENTIFIC AMERICAN, who saw the proof of what is here stated, also drew half a glass of what looked like pure soda water from a copper fountain received only a few hours previous, when the application of a simple reagent for copper instantly turned it to a dark red. The last glass drawn before this had presumably been drunk by some customer. The amount of metallic poisoning it is possible in this way to inflict upon the public is not a pleasant subject to contemplate.

Pure carbonated waters are certainly cheap enough, and there should be no excuse for dealers who neglect to furnish themselves with apparatus by which such beverages can be furnished with a certainty that they will be non-poisonous.

Petroleum Springs in India.

The Government of India have received reports of the preliminary examination of the oil bearing strata which exist in the neighborhood of Sibi. The professional reports are of a character so decidedly encouraging that the Government have determined to procure from England the necessary machinery for boring operations. These will begin next winter, and will be conducted on an extensive scale. If the results justify the sanguine hopes entertained, the discovery will be one of no trifling importance.

WIREWORMS AND SKIPJACKS.

In turning up the soil round garden plants we sometimes find a stiffish, elongate, shiny, yellowish-brown, worm-like thing, about the thickness of a stout pin, and about three-quarters of an inch in length. Under the impression that any living creature found in garden soil is an intruder that should be summarily disposed of, we may proceed to endeavor to put these ideas into practice, only, however, to find that this is not quite so easy a matter as it seemed; the thing is so stiff and tough, that even a good hard squeeze seems to make but little impression on it. This tough, worm-like thing is a wireworm (Fig. 1), and so dire a foe is

Fig. 1.—WIREWORM, MAGNIFIED.

it to vegetation that we are perfectly justified in making all efforts to dispatch it. On examining it more closely, we find that it is not truly cylindrical, like a piece of wire, but somewhat flattened beneath, and that it is made up of a series of thirteen segments, placed in line, one behind the other. The first of these is the head, and the next three carry six short legs, one on each side of each segment, with which the creature crawls along, trailing the remainder of its body after it. The head is black, and is furnished with a pair of stout, transversely moving jaws, and a pair of short antennæ.

Wireworms are the larvæ of various kinds of beetles, called "skipjacks" or "click-beetles," from a peculiar habit of springing up into the air, and, at the same time, producing a sharp clicking sound. Skipjacks are narrow, elongate insects, with short legs and hard integuments (Fig. 2). The

Fig. 2.—CLICK BEETLE (*Agriotes obscurus*).

head is small and often much sunk into the thorax, and carries a pair of long, distinctly jointed antennæ; the thorax is of large size, and, roughly speaking, more or less quadrangular in outline, and convex above and beneath. The elytra or wing cases cover the body, and conceal a pair of ample membranous wings. Each is somewhat triangular in shape, and they form when closed a strongly arched, shield-shaped surface; they are usually marked longitudinally with parallel grooves or furrows, and covered more or less densely with short hairs. The under surface also is strongly convex, and the legs are short, and capable, like the antennæ, of being folded close up to the body. When thus compactly folded up, the insect may easily be mistaken for a piece of stick or earth. When surprised or alarmed, it will thus feign death, relaxing its hold of what it may have been clinging to, and falling to the ground, as often as not, on its back.

Now usually, when a beetle gets into such a position, it frantically waves its legs about till one of them by chance strikes the ground; then, seizing any irregularities of surface with the sharp claws at the end of its feet, and assisting itself with the end of its shanks it levers itself over sideways. But, owing to the convexity of its back and the shortness of its legs, a skipjack is unable to use this method, unless there happen to be close to it some objects of sufficient height to be reached by its waving legs; failing this, however, it would be, were it not for a remarkable contrivance, as helpless as a turtle in a similar position, and would stand a good chance of being doomed to continue its unavailing struggles, at the mercy of any passing foe, till exhaustion ended its woes by death.

The contrivance is as follows: The hinder edge of the thorax is produced in the middle underneath into a long, curved, blunt spine, which is received into a little pit at the base of the body. The thorax is loosely articulated to the abdomen, and can be freely moved up and down, like the lid of a box on its hinge. When on its back, therefore, the skipjack arches its body by bending its thorax backward, and so balances itself on the two extremities of its body; this movement releases from its hollow the spine above referred to. Having stretched itself to the utmost in this attitude, the insect suddenly and forcibly resumes its former supine position—a movement which has the effect of causing it to rebound from the ground and shoot upward into the air to the height of several inches, at the same time bringing the spine back into its sheath with a sharp clicking sound. On returning to the ground, the insect generally manages to land itself right side up; if not successful the first time, however, it renews the attempt, and continues skipping till the desired result is obtained.

About sixty species of skipjacks belong to the British fauna, and three or four of them, brownish insects belonging to the genera *Athous* and *Agriotes*, are exceedingly common; the latter genus furnishes the most destructive wireworms. In their larval existence they are subterrancean in habits, living for several years a little below the surface, and spending their time in devouring the roots and underground stems of plants, and thus, of course, doing much more harm than can be measured by the amount of matter actually devoured. In the winter they retire to a greater depth, descending farther and farther as the frost increases, and pausing in their depredations only in the coldest weather. They devour all kinds of agricultural produce, destroying both root, grain, and fodder crops. Carrying on the ravages as they do in the complete obscurity of subterranean life, they are rarely detected when at work, and the first evidence that the fatal work has been done is seen in the apparently causeless withering of the plants.

It is fortunate that creatures so destructive have natural enemies Among the most important of these is the mole, which devours the larvæ with avidity. It is aided in its praiseworthy efforts by several kinds of birds, such as rooks and lapwings. A variety of artificial remedies have been proposed for checking the spread of the mischief, such as the application of liquid manure, which has the twofold effect of strengthening the plants that have not been irreparably injured, and driving away or killing the wireworms; paring off a thin coating of the soil, which will contain most of the insects, and then burning it; embedding in the soil at short distances apart slices of carrot and turnip to serve as traps, and then examining them and destroying the wireworms every other day. The latter method has been found serviceable in hop grounds, as many as 150 wireworms having been trapped close to a single hop hill. It should be remembered in this connection that the abundance of many agricultural pests is due in great measure to man himself. We greatly increase the supply of suitable food for these creatures, and in other ways make the surroundings more and more favorable to their existence, and we need not wonder, therefore, that the inevitable result follows, and that the additional task devolves upon us of devising means to counteract the excessive development we have ourselves unintentionally occasioned.—*Knowledge.*

Banknote Paper.

The banknote paper on which American legal tender, national banknote currency, and government bonds are printed is made entirely at Dalton, Mass.

If you should happen to stop at the paper mill, with proper introduction and credentials, you may perhaps be allowed to handle a sheet of the crisp paper, where, as the wet, grayish pulp is pressed between heavy iron cylinders, bits of blue and red silk are scattered over its face and silken ribs laid on its surface. You may go beyond into the counting room, where each sheet as it comes from the drying room is carefully examined and counted and then returned to the paper cutter to be divided into smaller sheets. If you trace this paper still further, you will find that from the cutter's hands it passes again into the counting room, and is separated into little packages containing 1,000 sheets each, the amount recorded in a register, and then packed in bundles and stored in fire and burglar proof vaults to await shipment to the United States treasury.

From the pulp room to the vault the precious paper is watched and guarded as carefully as though each sheet was an ounce of gold. Its manufacture is one of the greatest secrets connected with the government's money making. From the vaults of the paper mill at Dalton to the guarded store rooms of the treasury at Washington is a journey of several hundred miles. In the capacious vaults of the treasury building, among gold, silver, copper, and nickel coins, bullion, paper currency, and official records, you will find thousands of packages of the banknote paper made at Dalton. It comes in little iron safes, such as are used by the Adams Express Company, and each package and every sheet is carefully counted before the manufacturer and express company are relieved of further responsibility. The paper that arrives to-day may lie in the treasury store room for years, or it may be sent to the Bureau of Engraving and Printing to-morrow, to return in the course of a month's time a legal tender or bank note.—*Geyer's Stationer*

A Scientist's Cheerful Workshop.

A biography of Louis Pasteur, just completed by his son-in-law, gives the following description of the surroundings of the great French investigator at his daily work: All the animals in the laboratory, from the little white mice hiding under a bundle of cotton wool to the dogs barking furiously from their iron railed kennels, are doomed to death. These inhabitants of the place, which are marched out day after day to be subjected to operations or other experiments, share the space with still more ghastly objects. From all parts of France hampers arrive containing fowls which have died of cholera or some other disease. Here is an enormous basket bound with straw; it contains the body of a pig which has died of fever. A fragment of a lung, forwarded in a tin box, is from a cow which died of pneumonia. Other goods are still more precious. Since Pasteur two years ago went to Pauillac to await the arrival of a boat which brought yellow fever patients, he receives now and then from far-off countries a bottle of black vomit. Tubes of blood are lying about; and plates containing drops of blood may be seen everywhere on the work tables. In special stores bottle-like bladders are ranged. The prick of a pin into one of these bladders would bring death to any man. Inclosed in glass prisons millions and millions of microbes live and multiply.

Trees for Shelter and Ornamentation.

Besides the value and importance of forest trees in many other ways, there is the shelter, beauty, and richness manifested in endless variety; and no landscape would please the taste of the man of culture and refinement without having in its composition trees of some kind. It is quite possible, and not at all uncommon, to have too many trees in the landscape, and where their distribution is in the form of lines, rows, and single trees, it is quite easy to see how the whole district may be made to assume the general appearance of a vast, irregular wood or plantation. General mixing, like general distribution of trees, is a subject which requires more attention than is generally given to it. What should be aimed at is definiteness and well defined features in all its aspects, without formality or stiffness. The trees should not be so distributed as to present an irregular, undefined, and incomprehensible mixture, either of species mixed together or in the distribution and arrangement of the trees upon the ground.

One thing that often leads to disfiguration of the landscape is the manner and form in which the planting is originally done. The great mistake here consists in not calculating to what height and proportion the trees would attain when mature and full grown. In planting shrubs or trees which bear cropping and keeping in subjection, there is little hazard or likelihood of going wrong, because in such cases the means of cure are kept in hand. If the shrub rises too high it can be headed back, and if too broad it can be reduced to the desired circumference. With medium sized trees, as the hawthorn, laburnum, mountain ash, and small leaved maple, a similar mode of treatment may be applied without prejudice.

Where the fields are small, and the whole domain of circumscribed and limited extent, the whole arrangement of distribution of the trees should be in proportion. Where the villa garden and pleasure ground are all comprised within a small area, it is often, under such circumstances, found necessary to plant medium instead of primary forest trees. By doing this the same effect is produced as by large trees in an extensive domain. Attention should also be paid to the distance the trees are planted from the garden walls, to the dwelling, or to any other object with which they might interfere when grown up.

The north and east sides of a house and premises should always be well planted, so as to afford the greatest amount of shelter, and the west and south sides left open to the sun. This in all planting, all authorities agree, should be adhered to, and the cases are extremely rare and exceptional where the rule should be departed from. The kinds or species of trees to plant have entirely to be regulated by circumstances; for the soil, situation, altitude, and climate so vary in different places that what would be suitable in one place would not at all do in another. As a general rule, in planting a new place or reorganizing an old one, it will be economy to employ a competent landscape gardener to lay out the grounds, establish the grade, and select and plant the trees and shrubbery. Much of the disappointment in country homes results from the mistakes made by the inexperienced owners in directing their improvements, and in this connection we think we may confer a favor to some of our readers needing the counsel or active services of an experienced landscape gardener by giving the address of Mr. O. C. Bullard, who resides at 122 Macon Street, Brooklyn, N. Y.

Mr. Bullard had charge of the tree planting in Prospect Park during the entire period of its construction, and his knowledge of the varieties of forest and ornamental trees is probably not surpassed by any one in this vicinity. The laying out of the grounds of Rev. Henry Ward Beecher's homestead, at Peekskill-on-the-Hudson, and the planting on his place of probably the greatest variety of ornamental trees to be found in any private grounds in the country, was the work of Mr. Bullard.

OVER $750,000 was paid last year as duty on patent medicines in England.

SHANKS' COMPOUND ENGINE FOR SMALL VESSELS.

In the compound engine represented herewith in perspective, the use of connecting rods and guides is done away with, and a return has been made to the old arrangement of a circular eccentric sliding in a frame connected with the piston rods. This engine has been specially devised for small craft, and is provided with a surface condenser and a reversing mechanism. It may be seen from a simple inspection of the figure that such a type of motor is well adapted for use upon small vessels, since it is capable of developing a great power while occupying but little space. All its parts, in fact, are grouped in a very ingenious manner, and in such a way as not to interfere with ease of access to them. The cylinders, which are quite close to one another, are connected by strong iron castings, which also carry the bearings of the driving shaft. After the steam has once operated at a high pressure, it enters the large cylinder without passing through an intermediate reservoir.

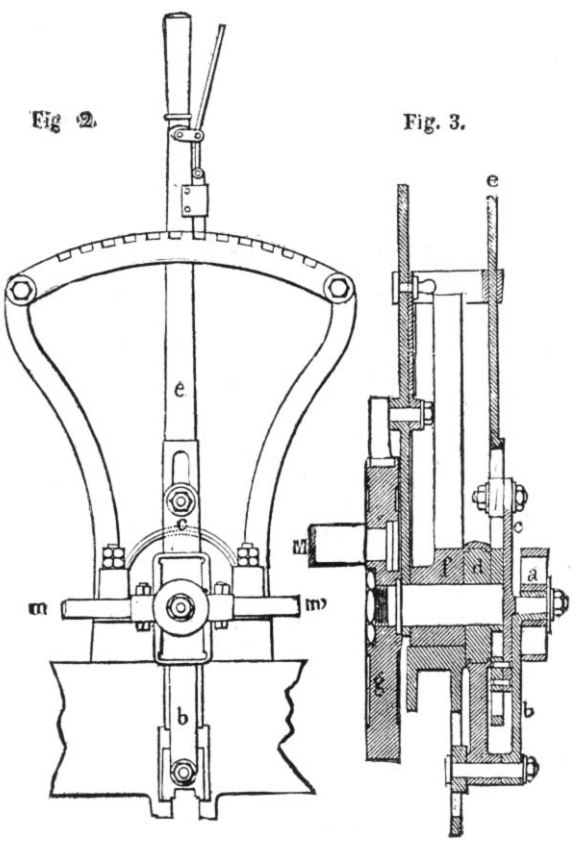


Fig. 2.—REVERSING GEAR.

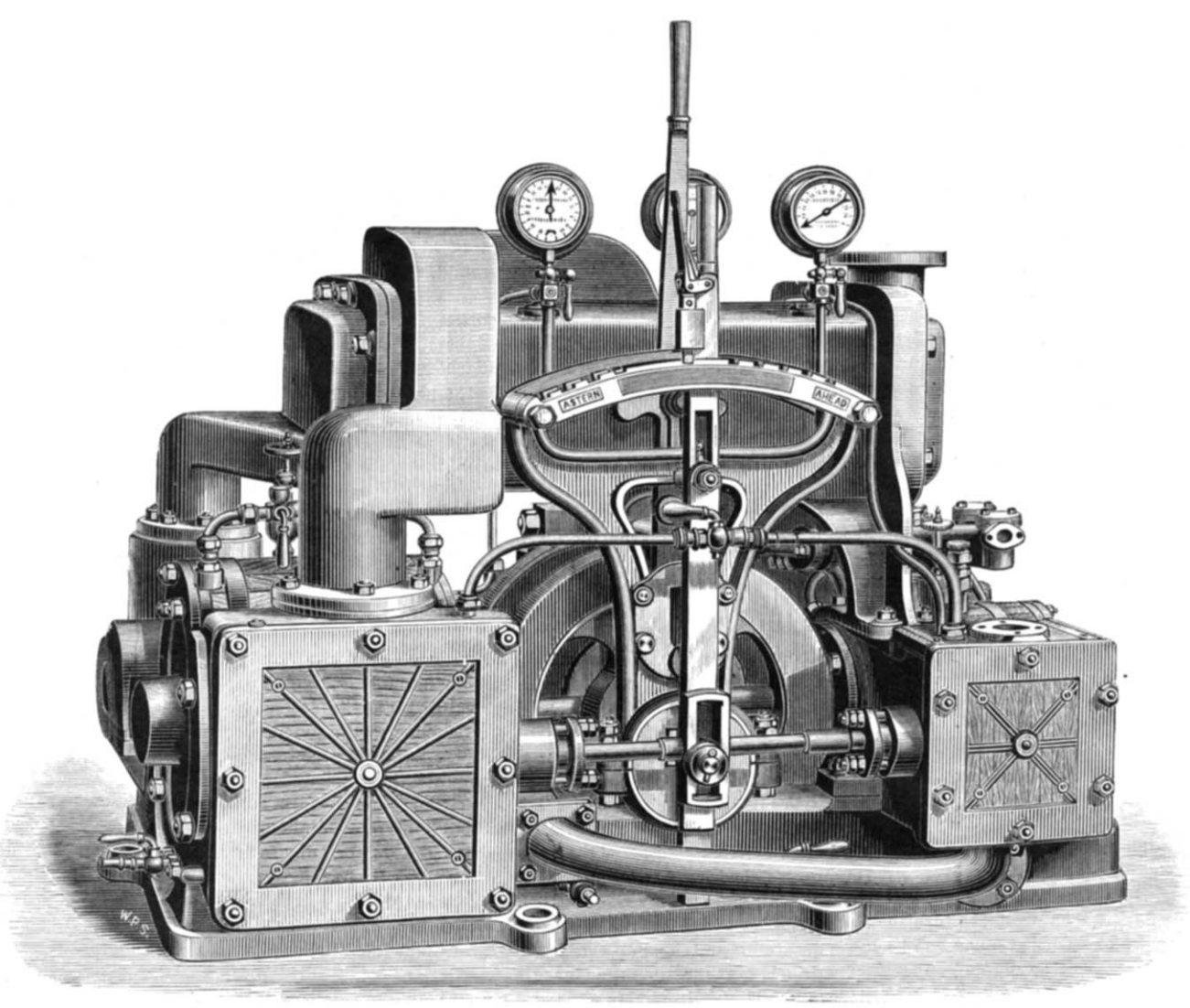


Fig. 1.—SHANKS' COMPOUND ENGINE.

The reversing gear is particularly interesting, and for this reason we devote to it two detailed figures, one of which, in section, shows how the different parts are mounted. The two rods, *m m'*, of the distributing valve are situated in a line with one another and are connected with a small vertical frame. Upon this guide there moves a slide, *a*, whose oblique changes in direction bring about a motion of the slide-valves. To effect this, the slide is connected with a flat bar, *c*, which is capable of moving to and fro upon the reversing lever, *e*. In this latter there are slots which serve to guide the motions of the piece, *c*, by means of nuts placed on each side of the axis of rotation. The latter is simply screwed into a plate, *g*, carrying a crank pin, M. Finally, a second flat bar, *b*, embracing at one of its extremities the slide, *a*, is jointed at the other with the rod of an eccentric, *d*. The axis of this assemblage is prolonged behind in such a way as to enter a fixed guide contained in the frame, *f*. The figure represents the reversing lever held at the stop notch in the toothed sector.

It is now easy to understand that the eccentric, *d*, causes the bar, *b*, to move to and fro along the lever, *e*, and according to a certain angle with the direction, *m m'*. Consequently the slide valves move at each stroke a distance equal to the horizontal projection comprised between the extreme points occupied by the slide, *a*, in its movement.

Messrs. Shanks & Son are likewise building after the same plan a series of reversible engines of all dimensions, of from six up to a thirty nominal horse power. The high pressure cylinders of the largest and smallest models have a diameter of 26 and 15 centimeters respectively, while the dimensions of the bore of the expansion cylinder vary between 56 and 33 centimeters.—*Revue Industrielle.*

Repairing the Mail Sacks.

According to Mr. H. G. Pearson, Postmaster of this city, the Government spends about $50,000 a year for the repair of mail pouches; there are about 100,000 mail bags in use, and about 10,000 new ones are bought yearly. The weakest point in the mail sack is where it closes and opens. In closing the bag the staples are pushed through the slots, and project an inch or more. When the bag is thrown about, the staples soon bend and often break. It looks strange that this little item should cost the Government so much money, and it seems as if our inventors ought to invent a new mail bag and obviate the objection referred to in the old one.

A Suggestion to Chemists.

The low price crude coal oil sells for at present—about 63 cents a barrel, something like 20 cents a barrel, it is said, below the cost of producing it—suggests to the *Independent Record*, a newspaper devoted to oil, paint, drugs, chemicals, etc., that coal oil may be manufactured into a great variety of useful articles which our chemists have not discovered its use for yet.

This favored article, in the crude state, is worth say 60 or 70 cents per barrel. Refined, it brings five or six times that amount. Under proper and skillful treatment it yields products of greatly increased value. The *Record* counsels the discouraged men of oil to devote more time and money to the various by-products of petroleum, and less to the producing of crude and the making of refined. Bring to your assistance the chemist and the laboratory, and create from cheap oil that which it contains.

A pound of raw iron is worth a penny or two. A pound of watch springs is another thing, and the mill of the maker of raw or cheap iron may be closed and his men hungry, while the dealer in fine steel and specialties in iron is unconcerned, and his wares in constant demand. Cheap oil offers a better return to the maker of any of the scores of petroleum's products than does crude oil at one dollar a barrel. There are specialties in the way of lubricants, petroleum jellies, paraffine wax, dyes, etc., which must enjoy a constant demand irrespective of the condition of the market for crude or refined. In the making of these will be found an employment for capital which must lift the manufacturer far above the realm occupied by the mere producer or refiner.

The Cocoon of a Spider.

At a recent meeting of the Academy of Natural Sciences, of Philadelphia, Dr. H. C. McCook stated that, while walking in the suburbs of Philadelphia lately, he had found under a stone a female Lycosa, probably L. riparia Hentz, which he placed in a jar partly filled with dry earth. For two days the spider remained on the surface of the soil, nearly inactive. The earth was then moistened, whereupon she immediately began to dig, continuing until she had made a cavity about one inch in depth. The top was then carefully covered over with a tolerably closely woven sheet of white spinning work, so that the spider was entirely shut in. This cavity was fortunately made against the glass side of the jar, and the movements of the inmate were thus exposed to view. Shortly after the cave was covered the spider was seen working upon a circular cushion of beautiful white silk about three-fourths of an inch in diameter, which was spun upward in a nearly perpendicular position against the earthen wall of the cave. The cushion looked so much like the cocoon of the common tube weaver, Agalena naevia, and the whole operations of the lycosid were so like those of that species when cocooning, that it was momentarily supposed that a mistake in determination had been made.

After the lapse of half an hour, it was found that the spider had oviposited against the central part of the cushion, and was then engaged in inclosing the hemispherical egg-mass with a silken envelope. The mode of spinning was as follows: the feet clasped the circumference of the cushion, and the body of the animal was slowly revolved; the abdomen, now greatly reduced in size by the extrusion of the eggs, was lifted up, thus drawing short loops of silk from the expanded spinnerets, which, when the abdomen was dropped again, contracted, and left a flossy curl of silk at the point of attachment. The abdomen was also swayed backward and forward, the filaments from the spinnerets following the motion as the spider turned, and thus an even thickness of silk was laid upon the eggs. The same behavior marked the spinning of the cushion, in the middle of which the eggs had been deposited. The ideas of the observer as to the cocooning habits of Lycosa were very much confused by an observation so opposed to the universal experience. Upon resuming the study after the lapse of an hour and a half, he was once more assured of being right by the sight of a round silken ball dangling from the apex of the spider's abdomen, held fast by a short thread to the spinnerets. The cushion, however, had disappeared. The mystery, as it had seemed, was solved; the lycosid, after having placed her eggs in the center of the silken cushion and covered them over, had gathered up the edges, and so united and rolled them as to make the normal globular cocoon of her genus, which she at once tucked under her abdomen in the usual way.

This was a most interesting observation, which Dr. McCook believed had not before been made. The manner of fabrication of the cocoon of Lycosa had been heretofore unknown to him, and, by reason of her subterranean habit, the opportunity to observe it was of rare occurrence. He had often wondered how the round egg-ball was put together, and the mechanical ingenuity and simplicity of the method were now apparent. The period consumed in the whole act of cocooning was less than four hours; the act of ovipositing took less than half an hour. Shortly after the egg-sac was finished, the mother cut her way out of the silken cover. She had evidently thus secluded herself for the purpose of spinning her cocoon.

Dr. McCook also alluded to another interesting fact in the life history of the Lycosa, which had been brought to his attention by Mr. Alan Gentry. A slab of ice having been cut from the frozen surface of a pond about eight or ten feet from the bank, several spiders were observed running about in the water. They were passing underneath the surface, between certain water plants. It is remarkable to find these creatures thus living in full health and activity in mid-winter, within the waters of a frozen pond, and so far from the bank in which the burrows of their congeners are commonly found. It has been believed heretofore, and doubtless it is generally true, that the lycosids winter in deep burrows in the ground, sealed up tightly to maintain a higher temperature.

Golden Streets.

The well known French electrician, M. Louis Maiche, has found that there is gold to be obtained from the quartz with which the roads round Paris are paved. M. Maiche has extracted small quantities of the precious metal by crushing the stone and treating it with mercury. We have not yet heard of the formation of a company for working the streets of Paris to obtain this gold, nor do we suppose that there will be much of a rush for the new "diggings."

EVEN delirium tremens is now traced to a micrococcus: "the worm of the still."

ELECTRICITY WITHOUT APPARATUS.

(1) To produce an electric spark, it is only necessary to warm a sheet of ordinary paper in front of a good fire or stove or over a lamp. Upon going into a dark place and applying the knuckle to the paper a very decided spark will start from the latter, accompanied by a slight crackling sound.

(2) Take two sheets of paper and interpose a sheet of gold-leaf between them. After electrifying them as above described, it will be only necessary to pass a pencil point in a

AN ELECTRIC SPARK FROM A SHEET OF PAPER.

zigzag manner over their surface to cause the appearance thereon of a luminous flash of considerable intensity.

These experiments, which are very easy to perform, may serve to demonstrate the fundamental rules of static electricity to children.

Fireproof Paper.

A fireproof paper is made by a combination of asbestos and infusorial earth.

About forty parts, in bulk, of fine or disintegrated asbestos fiber and about sixty parts of what is known as "infusorial earth" are taken and placed in a dry state in an ordinary beating engine, and then sufficient water is added while the machine is in operation to beat the mass into pulp just thin enough to form upon an ordinary cylinder. The web is taken from the cylinder and finished in the usual manner. The asbestos fiber is long enough to give strength and elasticity to the paper, and the infusorial earth, which is a good non-conductor of heat, and fireproof, forms a filler or padding, the two adhering together strongly and forming a flexible paper, which may be used wherever ordinary paper board is employed, it differing, however, from ordinary board in being fireproof.

The infusorial earth should be calcined before use to free it from impurities not fireproof.

If desired, and in some instances, a small quantity of lime, starch, or other cementitious substance is added. The proportion of asbestos and infusorial earth may be varied.

THE TARANTULA OF SOUTHERN CALIFORNIA.

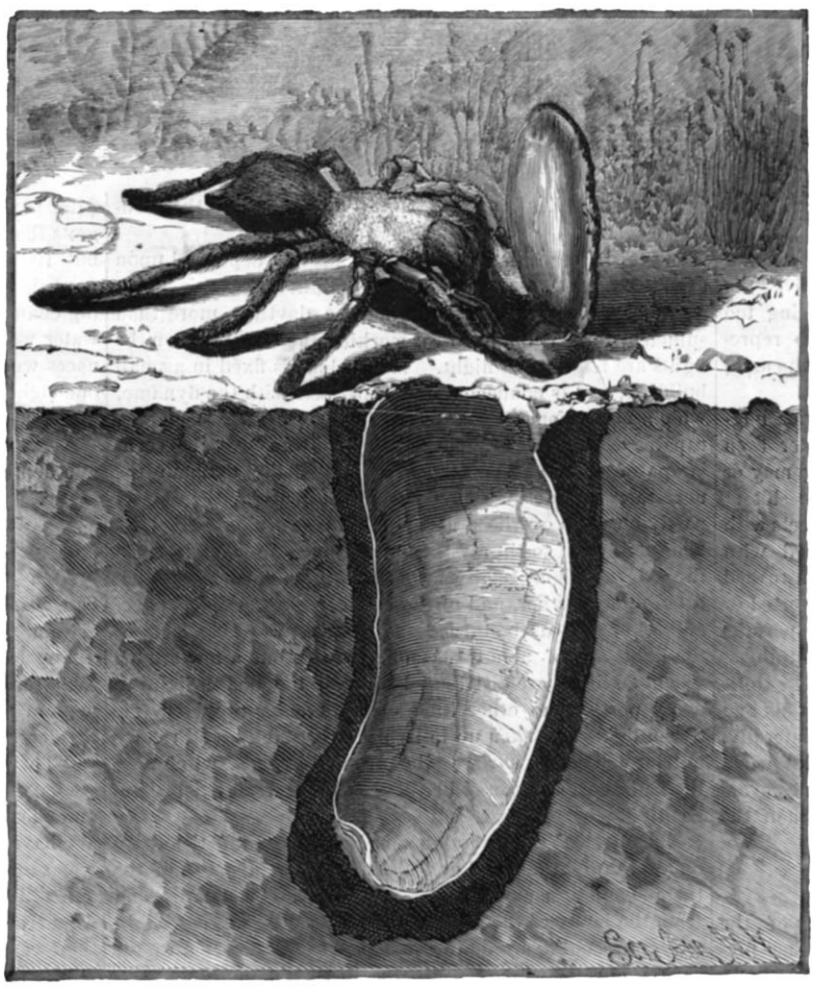
Ugly, vicious, energetic, and to a certain degree poisonous, are the spiders that infest the southern part of California, and yet when closely studied they present many peculiar characteristics, both in regard to their structure and habits. Among the most valued trophies tourists carry away with them from the coast are neat cards adorned with these animals, and a case containing the nest so arranged as to show it wonderful trap door and the delicate lining of the interior. The adobe ranches are full of these strange little habitations, and some of the sunny valleys among the foot hills are literally strewn with the small tunnels, capped with the almost invisible door. Our engraving shows the tarantula (*Mygale hentzii*) as he is about to enter his abode, both being full size.

The general appearance of the tarantula is very clearly shown in the engraving. The legs are larger, and are not furnished with so long and dense a growth of hair as are the specimens found in other sections of the Southwestern States. The back is covered very thickly with extremely fine short hair; the back and the outer joints of the legs are of a light brown color, the remainder being of a deeper shade. The forward part of the head is divided, and each division terminates in a sharp, downwardly curved, and jet black horn or hook.

The tarantula pounces upon his prey, and thrusting in the hooks most securely holds his victim. It is seldom met in the daytime, preferring to seek its food during the night, returning to its nest in the early morning. Although pugnacious when cornered, he will not seek a fight, and is more anxious to escape than the stranger whom he chances to meet.

This tarantula is justly celebrated for the architectual skill he displays and for the luxurious comfort of his dwelling. Having selected a suitable site, he digs a hole varying from four to eighteen inches in depth, and just large enough around to admit him easily, although it is puzzling to conceive how he ever gets his long, ungainly, and many jointed legs comfortably disposed in so small a space.

The walls are carefully smoothed, and are completely covered with an exceedingly fine fabric of his own manufacture. The top of this tunnel is slightly flared, and in this widened part is fitted the door, which is hinged at one side so that it may be easily lifted. The inside of the door is finely finished, and covered with a web similar to that on the sides. The tarantula knows that this door is not heavy enough to insure a tight fit when it is dropped, so he makes a small handle near the center of the under side by which he pulls the door closely down, thereby insuring a joint that most effectually excludes all dampness from his abode. The handle is a strong web, the two ends of which are attached to the door at points about one-sixteenth of an inch apart. The outside of the door is placed about at the level of the ground, and is so nearly the same color as the surrounding soil that it can be discovered only after the most careful search. The joint of the door is so well made and the colors are so nearly alike that it is almost impossible to ascertain upon which side the hinge is placed, except by raising the door. The framing of the door seems to be a coarse, strong web, which is extended at one side to form the hinge, and which is bonded with earth to give it the requisite stiffness. The hinge is about three-eighths of an inch wide, and acts as a spring to shut the door immediately after the owner's exit. For the tarantula and nest from which our engraving was made, we are indebted to the courtesy of Mr. H. J. Finger, of Santa Barbara, Cal.



THE TARANTULA OF SOUTHERN CALIFORNIA.

Preparation of Aluminum.

According to an account which the SCIENTIFIC AMERICAN finds in *Chemiker Zeitung*, ferro-silicium is mixed with fluoride of aluminum in equal proportions, and the mixture is exposed to a fusing heat. The materials decompose each other, and volatile fluosilicium with iron and aluminum are produced, the latter two bodies being alloyed together. In order to extract the valuable aluminum, a copper alloy is formed by melting the iron alloy with metallic copper; by reason of the greater affinity of the copper for aluminum this is secured, leaving with the iron only a slight residue of aluminum. When the fused mass is cold, copper bronze and iron have so settled that both bodies can be easily separated. In place of the pure fluoride of aluminum, chloride can be used, when chlorsilicium and iron aluminum alloy are formed. If in practice the chemical reactions above outlined are found to hold true, this patented process promises to be of considerable value.

LARGE fortunes are rare in Switzerland, and the salaries of public functionaries very modest. The President of the Confederation receives $3,000 a year, few judges more than $1,250, and there is probably no bank manager in the country who gets more than twice that amount. A man with an income of $2,500 is considered very well off indeed, and to have $5,000 is to be rich.

"Crackle" Glass.

This variety of glass, which has become so fashionable on account of its effective and crackled appearance, is, according to the *Glassware Reporter,* very easily made.

It is produced by covering one side of a piece of plate glass with a thick stratum of a flux or readily fusible glass, mixed with coarse fragments of glass. In this condition it is placed in a muffle, or an open furnace, where it is strongly heated. As soon as the flux is melted and the glass itself has become red hot, it is removed from the furnace and rapidly cooled. The flux (or fusible glass), under this treatment, cracks and splits, leaving innumerable fine lines of fracture over its surface, having much the appearance of scales or irregular crystals, which cross and intersect each other in every direction, producing very striking and beautiful effects when the light falls upon its surface.

The rapid cooling of the fusible coating is effected either be exposing the heated mass to the action of a current of cold air, or by cautious sprinkling with cold water.

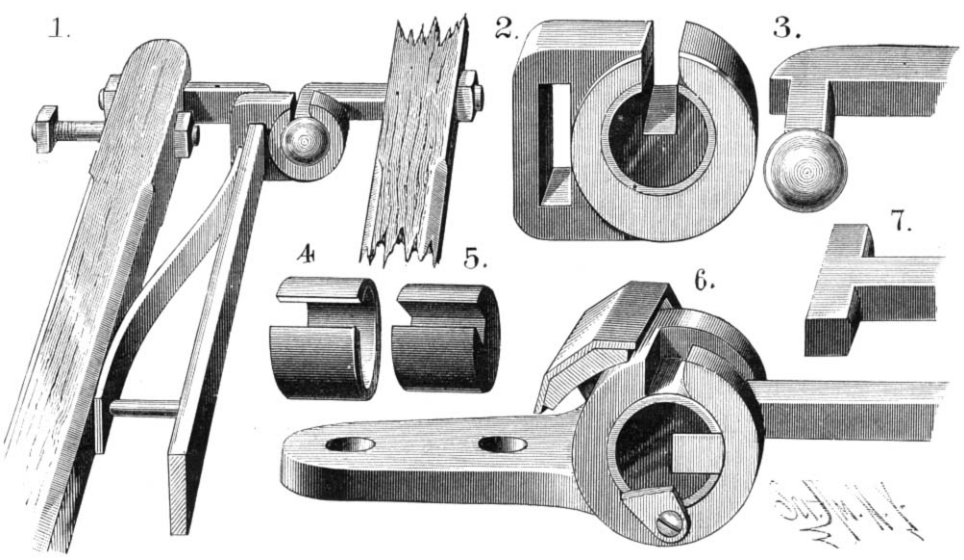
By protecting certain portions of the glass surface from the action of the flux, these portions retain their original smoothness and polish, and form a striking contrast to the crackled portions of the surface. By this means inscriptions or decorative designs of every description are produced upon a colorless or colored ground.

A modification of this method of producing crackle glass is the following: A coarsely granular flux is strewed upon the surface of a glass cylinder, while the latter is red hot, until the flux melts. It is then removed and rapidly cooled either by the use of water or by waving it about in the air. The stratum of melted flux is then caused to crack as above described. The cylinder is then cut, flattened, and brought to a level surface in the usual manner.

IMPROVED THILL COUPLING.

Our engravings show the various parts of a thill coupling, for which letters patent have been obtained by H. M. Wheeler, M.D., of Grand Forks, D. T. It is so made as to prevent all rattling, is strong and secure, and the change from thills to pole, or *vice versa*, can be effected in a very short time. Fig. 2 is a perspective view of the knuckle used on cutters; it is made of casehardened malleable iron, and is formed with a rectangular transverse slot and a circular transverse opening, the lower part of the forward wall being cut away to form a bevel. Within this opening is placed the incomplete metal ring, Fig. 4, which in turn receives the rubber packing, Fig. 5. In Fig. 3 is shown the L-shaped head, in which the thill or pole straps terminate, and Fig. 1 illustrates the application of the coupling to cutters. The heads are movable upon a flat iron bar which replaces the round rod ordinarily used in cutters, and which enters the transverse slot. The draw-heads are governed by springs as in other cutters, insuring side or central draught and giving the proper position for the pole when both springs are in use. Thills or pole to be inserted are placed in a vertical position, and the horizontal part of the head enters the slots and passes down into the recess in the rubber packing. They are then brought down into a horizontal position, the bevel serving to drive the metal into the rubber—the groove in the rubber being too shallow to receive it without pressure. Fig. 2 also represents, with slight alterations as to attachment to the axle, couplings for light buggies.

In the coupling, Figs. 6 and 7, designed for heavier buggies and road wagons, the draw-head is much wider than the one above described, and the circular opening may or may not extend through the head. The transverse slot at the top extends two-thirds across the top and intersects with a vertical slot. A cap or cover which is cushioned with rubber, is secured with rivets as indicated, and when turned back it permits the T-shaped head, Fig. 7, to be inserted or removed, and when turned completely forward it permits the removal of the metal cylinder. The two couplings, comprising the pair, work from the same side. The thills are placed vertically, the T heads inserted in the slots and pressed into the rubbers when they are moved laterally, until the stem of the head is opposite the vertical slot, when they are brought down to a horizontal position. The covers are then adjusted, and held in place by the friction of the rubber cushion.



WHEELER'S IMPROVED THILL COUPLING.

The Use of Old Muskets.

An exchange says that the condemned muskets of the Government—the Enfield and Belgian rifles and other firearms of the late war—find purchasers among Grand Army posts, amateur military companies, and speculators for foreign markets, some of them being converted into breech loaders for sporting purposes.

There is still another demand for them which is not generally known. Large numbers of smoothbore musket barrels are remounted and restocked, and are highly valued as duck guns and for other field sporting purposes, even without being converted into breech loaders. A sportsman, who is a very successful hunter, said recently that an old musket barrel restocked was his most valuable gun, and yet cost him only $8, and he has in his collection several of the most costly breech loading "stub and twist" guns, worth $100, more or less, each.

But whatever may be the value of these gun barrels, it is certain that a very large number find their way into the market as sporting guns. A gunsmith with an experience of twenty-five or thirty years lately answered, in response to an inquiry, that a very large proportion of his business was the alteration and remounting of old military gun barrels, which form a considerable portion of the sporting gun seller's stock in trade. The cost of these guns is very slight, and their market price brings them within the reach of most purchasers. But a gun with real twist barrel is a costly article. Instead of being rolled from a plate or "skelp" between grooved rollers and welded at one rapid operation, it is patiently hammered into a cylinder by hand. The mottled, damascened, or striated appearance is produced by a series of wires of differing irons twisted into cables and then welded into square rods. These placed side by side and heated to a weld are wound a half turn, or perhaps more, at a time on a mandrel, and seated (welded) against one another by repeated taps of a light hammer. The ribbon thus formed of cables of fine wire may consist of not less than thirty-six or even fifty-two strands of wire.

The Electric Light for Country Houses.

A very pleasing example of electric lighting for country dwellings is described in *The Architect* as having been introduced at Linden Park, near Hawick, N. B., the residence of Mr. Walter Laing. A small stream runs through the grounds, and advantage has been taken of this to obtain power for producing electricity for lighting the mansion and stables. A turbine wheel has been erected capable of giving off about eight horse-power, and requiring about 270 cubic feet of water per minute when working at full power. As the stream will not in dry weather give nearly so much as this, a reservoir, in the shape of a small lake of about an acre in extent, has been constructed in the bed of the rivulet.

In the driest weather the stream may be depended upon to give at least 80 cubic feet per minute, and this being stored up in the reservoir during the daytime, more than sufficient force is obtained for working the turbine when the lights are required at night. The turbine is fixed in a small building, and is connected by a short belt with the dynamo, which is a Siemens compound self-regulating machine, capable of supplying about seventy "Swan" incandescent lamps of 16 candle-power each. From the dynamo the necessary conducting wires are carried up to the house, partly on posts overhead and partly underground, branches being taken off to supply the stables and the avenue from the lodge. About 100 Swan incandescent lamps have been fitted up altogether, and of these 70 can be worked at once, and all or any can be turned on or off at pleasure. Most of the lights are of about 16-candle power, but a few are 32. About 80 lights are distributed through the house, lighting every portion, no other kind of light being provided for. Seven lights are taken up in lighting the stables, and twelve outside. These latter are all controlled by one switch near the hall door, and can either be lighted or extinguished instantly.

The effect of the instantaneous lighting up of the drive on a dark night is novel and pleasing. The distance of the turbine and dynamo from the house is about 350 yards, and from the house to the lodge about 400 yards, so that a circuit approaching a mile in extent has to be traversed by the electric current which goes to the farthest lamp. Very little attendance is required by the dynamo-machine or turbine, all that is necessary being to turn on the sluice valve admitting the water to the turbine when the lights are required, and it is only necessary for a man to inspect the machines about once in the evening.

For stopping the turbine at night when the lights are no longer required a simple electrical arrangement has been designed, by means of which the sluice valve can be closed from the house without going down to the turbine house. This is done by merely touching a handle, and so admits of the lights being burned late, and put out at any time without the necessity of keeping any one in attendance to turn off the water when done with. The steadiness of the lights is absolutely perfect, and there are no products of combustion whatever given off to contaminate the air of the room and spoil the decorations.

Natural Gas Fuel at Pittsburg, Pa.

At the recent meeting of the American Society of Mechanical Engineers at Pittsburg, the report of the committee appointed to investigate the whole subject of natural gas was made, and many interesting particulars given.

Though Pittsburg is within reach of three or four prolific localities, and gas has been used for many years, it is but recently that any organized effort has been made to use it on a large scale. Already there are a hundred and fifty companies chartered in the State, representing over two million dollars; and gas is brought from eight to twenty five miles for use in the city. Five-inch mains are being followed by eight-inch, new wells are being bored, and the time when Pittsburg shall become a smokeless city may not be far distant. Though the gas is used under a pressure of a few ounces, the pressures at the wells run from fifty to a hundred and twenty five pounds; this is due to the friction in the mains, five pounds being allowed for each mile. If the flow be shut off the pressure runs up much higher, and great difficulty has been experienced in making tight joints; cast iron is too porous, and ordinary pipe threads do not fit well enough. A number of new coupling devices were exhibited, in some of which a lead packing was used. No allowance for expansion need be made, as the gas maintains an even temperature of about 45° Fah. When gas is allowed to burn freely at the mouth of a well, the cold produced by the expansion is such that ice has been projected through the flames.

The gas is used in all kinds of furnaces for making steam, iron, glass, etc.; and electric light carbons, and the finest lampblack for printing inks, are made from it; but it is used with suicidal wastefulness, which causes anxiety, as many wells give out in less than five years. The report looks to its economic and safe control. For household use it might otherwise be dangerous; and such use has commenced, though no practicable method of deodorizing it has been found. Being composed largely (ninety-six per cent) of marsh gas, its value as a heating agent is high, and its density is about half that of air. One pound (23·5 cubic feet) of gas has a theoretical evaporating power of twenty-four pounds of water, twenty pounds having been actually evaporated. The best method of burning it is not generally known; experiments with injector burners show that they do not suck in sufficient air for complete combustion, and the best results have been from numerous jets in contact with the whole heating surface of the boiler. The value of the gas, as compared by evaporation tests with coal at $1.40 per ton, is only eight cents per thousand feet (which suggests that even our ordinary gas companies make profits), but its use is immensely more convenient; no stacks are needed, and the furnace reduces to a simple non-conducting chamber. The gas has just been turned on to the city water works. On the first day's excursion numerous furnaces were seen running with gas blown in through rough, one-eighth inch nozzles; and two or three lines of five-inch pipe lay on the surface of the railway embankment.

A gas well has lately been opened within the city limits, at a depth of 1,600 feet, on the property of Mr. Westinghouse.

Length of Our Lives Increasing.

At a recent international health exhibition held in London, Sir James Paget delivered an address before the association, the Prince of Wales being present.

The learned physician asserted that people live longer than formerly, and that less sickness prevails among the mass of people, and he then gives the following reasons for the decrease of mortality during the last few years:

"There is less from intemperance, less from immorality; we have better, cheaper, and more various food; far more and cheaper clothing; far more and healthier recreations. We have on the whole better houses and better drains, better water and air, and better ways of using them. The care and skill with which the sick are treated in hospitals, infirmaries, and even in private houses are far greater than they were; the improvement and extension of nursing are more than can be described; the care which the rich bestow on the poor, whom they visit in their own homes, is every day saving health and life; and even more effectual than any of these is the work done by the medical officers of health and all the sanitary authorities now active and influential in every part of the kingdom. But we want," adds the lecturer in closing, "more ambition for health—a personal ambition for renown in health as keen as is that for bravery or for beauty, or for success in our athletic games and field sports."

ENGINEERING INVENTIONS.

A gas engine has been patented by Mr. George M. Allen, of Terrysville, Conn. The piston is moved in the working cylinder by the expansion of heated air and gases, and there is no explosion, the engine being practically a hot air motor in which the air is admitted greatly in excess of that needed for the combustion of the gas

A car step has been patented by Messrs. Clarence C. Baker and Odaville Yates, of Albuquerque, N. M. The object of this invention is to provide an improved folding step for freight cars or station platforms, the step and its hangers being substantially pivot jointed, for securing interlocking and mutual support of its parts, and being readily folded and unfolded.

A straightway valve has been patented by Mr. Alexander B. Rohney, of Montreal, Canada. The valve is made in U-form, with its head or bend serving as the valve face, and the side arms, affording a free passage between them, shaped as cams, to act against shoulders of the valve case in seating the valve, with other novel features, making a valve with few and simple parts, and which is durable.

MECHANICAL INVENTIONS.

A gear wheel has been patented by Messrs. Benjamin W. and Joseph L. Leeson, of Litchfield, Ill. The teeth are convex on their backs and concave on the front or driving sides, giving them a better hold with chain gear, and they have a rubber cap or covering fitting tightly around them, so that a chain or gear wheel thus made will run almost as noiselessly as a pulley driven by a belt.

AGRICULTURAL INVENTIONS.

A cotton planter and fertilizer distributer has been patented by Mr. Pleasant R. Houpe, of Oak Forest, N. C. The hopper is made with inclined angular sides, one of which is bolted flat against the inclined handles, which form a support for the hopper, and there is a stirrer within the hopper, with various other novel features.

MISCELLANEOUS INVENTIONS.

A weather strip has been patented by Mr. William J. Devers, of Providence, Pa. The invention relates to that class of weather strips in which the strips are secured to the door along its edges, and consists in a novel construction and arrangement of parts.

A fire kindler has been patented by Mr. Clarence J. Canan, of Omaha, Neb. It consists of a corn cob coated or saturated with inflammable material, such as resin and tallow, pitch, etc., and a transverse supporting and ignition splint, being a cheap, clean, and effective fire kindler.

A combined hinge and blind fastener has been patented by Messrs. Warren S. Dwinel and Earl P. Mason, of Providence, R. I. The object of this invention is to improve lock hinges for window blinds, to effect which the construction is novel, and the device is cheap, strong, durable, and easy to operate.

A horse blanket has been patented by Mr. Clarence J. Canan, of Omaha, Neb. It is double breasted, and has two flaps at the front end, both of which are folded over the horse's breast, and held in place by means of straps and buckles, one of the flaps having a transverse slot through which the other flap can be passed.

A stench trap has been patented by Mr. Herman Pietsch, of Flatbush, N. Y. An exterior bowl or cup is connected to the inlet and outlet pipes, and so combined with a glass tube and cup as to make a trap of simple construction, which flushes and cleans itself automatically after use, and is made transparent, so the contents can be seen at all times.

A wagon jack has been patented by Mr. William H. Gray, of Neapolis, Ohio. It consists of a horizontal bed frame and vertical guides, in combination with a vertically sliding frame carrying two brackets for engaging the rack or wagon box, with a pawl and ratchet mechanism, for lifting racks and wagon boxes from the running gear of wagons.

A gin saw cleaner has been patented by Mr. Benjamin R. Eaton, of Middle Settlement, Ark. A shaft or mandrel is arranged to carry a series of disks to run some distance into the spaces between the saws; the disks have toothed margins as well as toothed edges, and the disks may alternately be brought into contact with one side and another of the saws.

A universal clock has been patented by Mr. Abraham M. Cory, of New Providence, N. J. It has a rotating dial annulus, surrounded by a fixed ring divided into degrees, so the time on each and every meridian will be shown at the same time; it has also additional disks to correspond with certain degrees, on which the names of places are printed on the same degree.

A secondary battery has been patented by Mr. Desmond G. Fitzgerald, of Brixton, County of Surrey, England. The invention consists in the manufacture of electrodes that are practically indestructible, by the use of suitable impervious and insulating material with which the electrode is in part coated, the internal resistance of the battery being not materially augmented if the protection be confined to the anode.

An ice machine has been patented by Mr. John Patten, of New York city. This invention relates to that class of ice machines in which cold is produced by vaporizing water by means of a vacuum maintained by removing the vapor as rapidly as it is formed, and it provides new and improved means for freezing a block of ice. The machine is so constructed that a layer of water is spread or distributed on a surface exposed to a partial vacuum, whereby water will be congealed, and although various ways of making it are provided for, the principle is always the same,

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

For Sale.—Patent Self-ventilating Funnel. Best thing out for making money. G. M. Wickliffe, Brook Neal, Va.

For Sale.—A surveyor's transit, a level, a large microscope, an aneroid barometer, and a protractor. Each the very best of its kind. Box 113, Charlottesville, Va.

Stephen's Vises. Special size for amateurs. See p. 13.

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Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

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Curtis Pressure Regulator and Steam Trap. See p. 12.

Munson's Improved Portable Mills, Utica, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423. Pottsville, Pa. See p. 14.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 13.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 286.

Drop Forgings. Billings & Spencer Co., Hartford, Conn.

Brass & Copper in sheets, wire & blanks. See ad. p. 30.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

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Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 30.

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THE ACT AUTHORIZING THE FORMATION OF CORPORATIONS. L. K. Strouse & Co., New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.
Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) W. F. asks how to transfer the ink from newspapers on to glass. A. The following is used to transfer engravings on to glass, and we think may be applied in the manner you desire. First, coat the glass with dammar varnish or else with Canada balsam, and let it dry until it is very sticky, which takes half a day or more. The picture to be transferred should be well soaked in soft water and carefully laid upon the prepared glass and pressed upon it, so that no air bubbles or drops of water are seen underneath. This should dry a whole day before it is touched; then with wetted fingers begin to rub off the paper at the back. If this be skillfully done almost the whole of the paper can be removed, leaving simply the ink upon the varnish. When the paper has been removed, another coat of varnish will serve to make the whole more transparent.

(2) G. J. R. asks a preparation to use for attaching a label to greasy tin. In filling cans with various kinds of oil the surface ofttimes becomes greasy, and something is wanted that will adhere to the tin on simply wiping off the oil. A. Use a dilute solution (1 to 20) of white gelatin or isinglass, or else a starch paste with which a little Venice turpentine has been incorporated while warm.

(3) C. B. wants a formula for making a coating for peanut candy to protect it from dampness. A. Try gum arabic and water, or a solution of gelatine and water of quite thick consistency. A coating of this would probably prevent any moisture from being absorbed after the candies were dried.

(4) H. C. says: I have a barrel churn 24 inches long and 22 inches diameter at the ends, and 24 inches in the middle. It is usually filled two-thirds full of cream for churning, and is turned about 55 revolutions per minute by hand, end over end. Can you determine from the above data about the power required to run it, and whether it would be practicable to use an electric motor to run it with? I mean a motor propelled by batteries. If so, about how many cells would I want? A. We should say that about one-quarter horse power would be required, and although it would be possible to use an electric motor, a dynamo machine would be necessary, and to run this latter, unless you had steam power, the plant would be so expensive that after all it would not pay you to attempt it. Batteries would be impracticable.

(5) R. B. B. asks how to prepare the enamel used on brass signs with black letters. A. A mixture of lamp black, oil, and patent drier is applied or filled into the spaces cut out in the brass; after being allowed to dry it is polished, and by continual polishing, in time, it assumes an enamel like appearance. Black baking japan is likewise used in many instances with brass signs.

(6) S. D. V. L. asks for a receipt to make salad dressing. A. Marion Harland gives the following: 2 hard boiled eggs, 2 teaspoonfuls salad oil, half a teaspoonful salt, 1 teaspoonful white sugar, half a teaspoonful made mustard, 1 teaspoonful pepper, 4 tablespoonfuls vinegar. Rub the yolks to a powder, add sugar, pepper, salt, mustard, and oil. Let it stand five minutes, and beat in the vinegar.

(7) C. H. K. asks: 1. What is the finish that is put on iron called "Tucker bronze," and how is it applied? A. Do not know of a Tucker bronze finish. Think it must be a local name. 2 What is the composition of genuine bronze, such as is used in manufacturing small ornamental hardware? A. Bronze for medals and ornaments:

Copper	89 parts.
Tin	8 parts.
Zinc	3 parts.
Another:	
Copper	82 parts.
Tin	3 parts.
Zinc	18 parts.
Lead	2 parts.

(8) J. E. G. says: A mechanic of my acquaintance uses a liquid glue which he says will keep for six or eight months and improves with age, can be spread on a joint and not clamped for an hour after, yet it will set in a reasonable time and make an excellent job. As he will neither sell nor give away the recipe, can you give one as good? A. Liquid glue may be prepared as follows: Take a wide mouthed bottle and dissolve in it 8 ounces best glue in half a pint of water, by setting it in a vessel of water and heating until dissolved. Then add slowly 2½ ounces strong nitric acid 36° Baume, stirring all the while. Effervescence takes place under generation of nitrous gas. When all the acid has been added, the liquid is allowed to cool. Keep it well corked, and it will be ready for use at any moment. This preparation does not gelatinize nor undergo putrefaction or fermentation.

(9) W. I. T. asks for a process of hardening gelatine so as not to render it brittle, but to be of about the consistency of tissue paper. A. The hardening of gelatine is brought about by adding potassium or ammonium bichromate and exposing the film to sunlight. The addition of glue and tannic acid will also produce a similar effect. The exact proportions to use are kept secret by the various owners of photo engraving processes, whose value depends upon the proper manipulation of the ingredients.

(10) H. V. asks how much salicylic acid to put in a barrel of paste so it will not sour or mould, or could anything else be used that will not stain or discolor and that would come cheaper? A. One part in 1,000 to 2,000 is the proper quantity to be used in order to prevent decomposition. Carbolic acid is an equally good preservative for your purpose, and is less expensive.

(11) W. A. asks (1) if salicylic acid is of any practical value for keeping eggs in quantities. A. It is generally stated that eggs plunged for one hour in a solution of salicylic acid, and in no manner treated otherwise, will be found perfectly fresh after three months. 2. What is salicylic acid? A. Salicylic acid is prepared by heating sodium phenate in a stream of carbon dioxide, phenol distilling over, while disodium salicylate remains behind. By decomposing the latter free salicylic acid is obtained. Both carbolic acid and salicylic acid are derivatives of coal tar, and the salicylic acid may be derived from crude carbolic acid. For the treatment of eggs, see the articles in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 317, or 101 and 308.

(12) C. C. C. writes: I want to make a canvas canoe thoroughly waterproof by using some form of India rubber. How can I obtain the rubber and how dissolve it? A. The cement which you require is made by fusing together equal parts of pitch and gutta percha, and to this there should be added about two parts of linseed oil containing five parts of litharge. The heat must be continued until the ingredients are uniformly commingled. It is to be applied warm.

(13) M. E. H. writes: I have several old broken and cracked meerschaum pipes. Is there any way that I can dissolve them to a moulding consistency? A. It is impossible to dissolve meerschaum and then mould it. Egg cement prepared by taking some white of eggs with as much water, beating them well together, and sprinkling in sufficient lime (slaked) to make the whole up to the consistency of thin paste, is sometimes used to mend broken pipes. This cement sets or becomes hard very quickly, and can be used at once.

(14) J. W. D. asks: Is there any way for closing a crack in a meerschaum pipe? And is there any way for taking the color out of them? A. See answer to above. We are informed that it is impossible to completely remove the coloring from pipes. Partial methods are kept as trade secrets by prominent makers of pipes, which they refuse to communicate.

(15) J. E. B. asks for a formula for making a waterproof covering for mirrors. A. Try pouring over the plate a varnish composed of gum dammar 20 parts, asphalt or bitumen 5 parts, gutta percha 5 parts, and benzine 70 parts. This varnish will set hard on the glass, and once dry we do not think that it will be affected by water.

(16) A. D. asks: Does magnetizing a watch destroy the vitality or strength of the steel springs and wheels so that they are easily broken? A. No; only interferes with its regularity and sometimes stops its running, because its parts that are of steel, particularly those that are hardened, such as pivots, springs, etc., become magnets, and by their attraction stop the action of the lever.

(17) F. & M. Dept. writes: Please say in your correspondent column whether scarf welded or butt welded links are strongest, and which is used for ship chains. A. Scarf weld is best. Butt weld is liable to part unless carefully done. Machine made ship chains are butt welded; hand made are scarf welded.

(18) W. L. B. asks how to tin malleable iron castings. A. The great secret is to make the castings chemically clean. This is done by means of a pickle, either of sulphuric and nitric acid in equal quantities by measure, with water in quantity to equal the acids—1 sulphuric acid, 1 nitric acid, 2 water. Dip the clean castings into a bath of melted tin covered with a coating of powdered charcoal and tallow. Drawing them through the charcoal and tallow, after thorough heating, will show them effectually coated.

(19) J. C. S. asks: Can you give me a formula for brass lacquer? A. The best uncolored lacquer is shellac dissolved in alcohol. Better make a saturated solution and then thin as you desire. Use the best white lac and 90 per cent alcohol. Add color if you desire, but it is better without. Dry in shade.

(20) W. S. C. asks how to set a steam valve on a common single slide valve engine to work the steam expansively. A. You can only work steam expansively with a common slide valve by having a good lap to the valve, and even then you cannot cut off short of ⅝ to ¾ the stroke advantageously. When the valve is properly made, the setting of it would be the same as any ordinary slide valve.

(21) D. T., Jr., who as a practical druggist, has made "almost tons" of fly paper, amends our recent answer to W. H. on this subject by suggesting the use of resin, boiled with enough raw linseed oil to make it very stringy; some add a small quantity of honey, but this is open to the objection that it draws so many flies as to materially increase the number to be got rid of.

(22) H. G. V. asks: 1. Is there any possibility of fire from steam pipes in a dry house for seasoning lumber, the pipes laid on wood? A. Many fires have been attributed to the contact of steam pipes with wood, but the pipes are never hot enough to cause a fire directly; steam pipes in contact with some soft woods, however, char them, and this charcoal, under certain conditions of limited supply of air, causes spontaneous combustion. 2. Is it necessary to have ventilation to increase the drying process? A. A little ventilation is best in a drying room for lumber. 3. What is the usual time for drying inch lumber at a temperature of 200 degrees, continuous day and night? A. It depends on kind and condition of the lumber; from two to four days.

(23) S. S. S. K. asks the best method of taking writing and ink stains out of books, without injuring the paper or leaving a mark. A. Hydrochloric acid diluted in five or six times the quantity of water may be applied with success upon the spot, and after a minute or two washing it off with clean water. A solution of oxalic acid, citric acid, and tartaric acid is attended with the least risk, and may be applied upon the paper or plates without fear of damage. Chlorine water removes perfectly stains of ink. In fact, almost any bleaching agent properly applied will accomplish this purpose.

(24) C. & Sons ask what method is best to heat a building, area 5,000 square feet, 3 stories—steam, hot air, or hot water, no steam in building. A. If you have no use for steam other than for heating, hot water has the preference for both cheapness and cost of care. It is more bulky than a steam apparatus and not largely in use for heating buildings, its principal use being for greenhouses. Hot air furnaces are the great staple of the United States for heating purposes on account of cheapness in first cost and least care. Everybody can manage a hot air furnace.

(25) S. F. asks: 1. Does wool, after being off the sheep's back, grow in length? A. It is possible that the wool on pelts grows while the pelt is moist, but we know of no authentic instance. 2. Does the hair of a human being grow after death? A. Exhumed bodies have given evidence of the growth of human hair after death.

(26) C. W. B. asks: 1. What kind of red paint does Alvan Clark use to polish lenses? A. Red oxide of iron, or rouge. 2. What kind of moulds do they mould table glassware in? A. The moulds for glassware are made of iron.

(27) S. K. writes: Two rollers, one larger than the other, are running together, and to prevent a side motion it is proposed to make the surface of contact of the larger one convex, and of the smaller one concave, so as to exactly fit. Will there be more friction, grinding, or rubbing, or anything of the sort in the case of the curved rollers, and if so, why? A. The friction will be greater in the curved face wheels, because the periphery in both wheels does not run at the same speed in all parts of the curve. Hence some part of the curved bearing slips, and thereby produces friction.

(28) J. W. M. asks: What will make paper transparent without using grease of any kind? And what is used to make photographs transparent, so that they may be painted on the back? A. Paraffine will make paper transparent. For rendering photograph prints transparent see SCIENTIFIC AMERICAN SUPPLEMENT, No. 297.

(29) J. M. W., referring to a former note in this column, says: There is no such bird either in this country or Europe as the "English sparrow." The house sparrow (*Passer domesticus*) is the bird meant. A. Very true; house sparrow is the correct designation, and thus only is the bird known in Europe, although so commonly styled here the "English sparrow."

(30) C. A. H. asks: What curve should I give a disk for grinding lenses of a certain focus? I think if I turn a disk of 2 inches curve it will grind a 2 inch focus lens, 5 inches disk, 5 inches focus, and so on up as high as one wishes to go. Am I right? A. You are nearly right in regard to the curve. Glass varies considerably in density, which varies the focal length a little for a given curve. You will find interesting articles on lens grinding and kindred subjects in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 139, 318.

(31) G. W. asks if there is any reliable rule for calculating the amount of hay in tons contained in a barrack or barn of given measurements. A. 270 cubic feet new hay, 216 to 243 cubic feet in stacks or mows, according to age or degree of settlement and dryness, weigh one ton of 2,240 pounds; 297 to 324 cubic feet of dry clover weigh a ton.

(32) H. C. C.—If the tinware is stained so that a little whiting on a rag will not clean it, you may use a weak solution of oxalic acid in water by wiping the surface with a rag slightly moistened with the acid water, and then wipe dry with a little whiting on a cloth.

(33) F. D. R. W. asks if there is any process for coloring iron or steel wire fancy colors—red, blue, yellow, green, etc. A. We do not know of any natural means of coloring the surface of steel wire of any other color than the blue and yellow due to oxidation by heating. A red color is produced by dipping the cleaned wire into a solution of sulphate of copper, the red being derived from metallic copper precipitated upon the wire. This may be given other colors by a chemical treatment of the copper surface, which may be preserved by lacquers. This treatment comes under the head of the various colors in bronzing copper, which may be made, by chemical treatment, an iridescent green or brown.

(34) W. H. W. asks: What is the reason that the suction of the pump in a hydraulic lifting jack is so small, those I am using having about one-sixteenth of an inch suction to an inch pump? A. The suction inlet and valves are made small to insure tightness. 2. Could you inform me if there are any machines in the market for twisting coal miners' auger drills? A. Special machines such as for twisting augers are not on sale. They are made to order for parties engaged in the business; more often home made.

(35) E. A. W. says: In a catalogue of optical instruments, I see the statement that an achromatic object lens will bear a power of fifty diameters for each square inch of its diameter. Will you please say whether this means that a lens one inch in diameter will bear a power of fifty, one two inches a power of two hundred, etc.? Also why a lens of one inch diameter of sufficiently long focal distance will not bear as high power as one of larger dimensions? A. The rule is good theoretically. The diameter is not the square. A 1 inch objective bears a power of 39, a 2 inch objective bears a power of 150, and so on. The capacity for power depends upon quality of definition and amount of light transmitted.

(36) G. W. P. asks (1) where he could get a speaking phonograph. A. Speaking phonographs are not on sale. A few have been made to order by experimenters. 2. What books treat on compressed air? A. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 140, 188, 282, 92, 279, 309. 3. What books would be profitable for a young man, intending to be a civil engineer, to read? A. Griswold's Railway Engineer's Pocket Companion $1.75, Trautwine's Field Practice $2.50, Trautwine's Embankments $2.00, Trautwine's Civil Engineer's Pocket Book $5. 4. How much it costs on an average to construct a mile of common railway track? A. About $10,000 per mile would be the lowest cost, and from that up to $100,000; no average can be given without definite knowledge of the line. 5. How large in diameter would a balloon filled with common coal gas have to be to lift 100 pounds? How large if filled with pure hydrogen? A. With coal gas about 26 feet, with pure hydrogen about 12 feet. 6. The process of making panclastite (described in SCIENTIFIC AMERICAN, vol. 1, No. 15, on page 227). A. The panclastite experiments referred to were made in France; we cannot give you further information on the subject than we have already published.

(37) G. P. A. writes: I have certain articles which I have been bronzing with copper. I would like to find something that would give me the same color and be cheaper. The way I am doing now I have to cover the iron with a coat of paint and then bronze over that; this makes it expensive. A. There is no cheap paint that will take the place of surface bronzing. You may mix the bronze powder with a light varnish and paint the work, and thus save a little time and trouble; but the material will cost more than by the present method. Chrome yellow mixed with a little vermilion, just enough to give it a light orange color, with a little varnish in the paint, to give it a gloss, may be also worth trying.

(38) "Mechanic" asks how to prepare the iron casting of any object to serve as a pattern for others. How to go to work to design in orthographic projection any object having warped surfaces or surfaces of double curvature, and surfaces following no law like the helicoid, for instance. From the drawing of such an object a pattern maker is to make a pattern having certain dimensions. A. Iron patterns should be thoroughly cleaned of the sand scale by pickling with sulphuric acid 1 part, water 4 parts, for several hours, then scrub the surface with a metallic brush, or smooth the roughness of the pattern casting with files or pieces of broken grindstone. When cleaned and made ready for a pattern, it may be warmed by any means to a temperature that will melt beeswax. Rub the beeswax all over the pattern, wipe off any excess that may lodge in cavities, leaving upon the iron pattern only a very thin coat of wax. When cold it will be ready for the sand. The method of projecting curved surfaces orthographically for pattern making is laid down in a series of illustrated articles in the SCIENTIFIC AMERICAN SUPPLEMENTS, embracing about 450 engravings, stitched in paper cover, $2.50.

(39) O. C. D. asks for an oxidizing dip to give an olive green to brass. A. Try Prussian blue with Scheele's green in muriatic acid and water, using proportions to trial for color; clean in clear cold water; no potash.

(40) M. C. H. asks: How can polished spring steel be blued without heating and drawing the temper? Can it be done by dipping? A. All the bluing of steel or iron presupposes a heating to a "blue temper." No "dip" will give the color. A superficial and temporary color can be given by using Prussian blue of Winsor & Newton's tube colors mixed with copal varnish and dried in a gentle heat.

(41) E. L. B. asks how to make his plow mould boards and land slides of iron hard enough to scour in black soil, without casting them in chilling moulds. A. Use hard iron—chromic ore and scrap iron—melted in an air oven by bituminous coal. This iron cannot be drilled, or chipped, or filed, and the bolt holes must be cored. No casehardening will be effective.

(42) I. S. B.—Your air pump, properly arranged, will not draw the water back; the air will rise if it can do so by replacing water, but there can be no perceptible compression of the water.

(43) M. B. asks for the best and simplest way to anneal crucible steel castings and the time taken to do so. Also some further particulars regarding the cheapest way of producing above castings. A. Annealing of steel castings in a small way may be done in the same manner as the annealing of forgings of steel, by heating in a forge fire to a full red and slowly cooling in a mass of hot ashes or lime; both mixed make a very good annealing bed. If there is a large quantity to anneal, an oven is the most economical. Something like a reverberatory furnace, which can be heated to a full red heat with its contents and then closed and allowed to cool gradually. Ordinary annealing may be done in from three to six hours, depending upon the condition and size of the castings. For casting small work, crucibles of plumbago are generally used, charged with the broken pieces of steel or scrap steel, sometimes tempered with a little cast iron and wrought iron scrap. The furnace being like those used by brass founders, with a strong draught on a large scale, the cupola is used much after the style of those for cast iron. It requires much more experience than we can teach to enable you to produce perfect steel castings. Many establishments have not succeeded until they have expended much money and valuable time in experimenting.

(44) C. T. M. writes: Is it beneficial to health to put on flannel clothing next the skin, especially during the daytime? Is there any harm in wearing such clothing in summer? A. The use of flannel next the skin has certainly nothing objectionable in it, either by day or by night, in winter or in summer. The personal comfort and convenience of the wearer alone can guide him as to it. Every one should wear underclothing sufficient to secure a proper amount of heat, and to guard against the effects of sudden changes of temperature; no more and no less. And consequently the amount needed for one may be either too much or too little for another. The material is not of itself important. It may be gauze, it may be silk, it may be flannel, it may be chamois leather, or buckskin, at choice.

(45) G. H. H. says: Can you give me a receipt for removing moles from the face? A. The moles can be removed from the face only by excision. The operation is slight and leaves only a linear cicatrix. Of course a caustic application might destroy the skin as completely, but it is not to be considered; the pain is great and the cicatrix disfiguring; all milder treatment is without avail.

(46) H. E. J.—For good recipes to make real fruit jellies, see SUPPLEMENT, No. 196. Gelatine is used to a very large extent by dealers. Much of the jelly put on the market, adorned with elegant labels, is composed of gelatine, colored, and flavored with essences, without the use of any fruit.

(47) F. G.—Disks are cut round by chucking them upon the revolving disk of the grinding machine with pitch. Make a hoop of brass or copper wider than the thickness of the glass to be cut; make it about one-thirty-second of an inch thick, with a stiffening piece at the upper edge. Fasten the hoop to an arm of metal or wood, so that you can retain it in a central position upon the glass. When adjusted, feed emery (No. 70) and water upon the glass, at the same time revolve the glass under the hoop and pressing down gently upon the hoop with the hand. The emery will spread under the edge of the hoop, and soon cut a groove entirely through the glass.

(48) B. C. F.—Your proposed connection of lightning rod with water pipe is a good arrangement. The rod should be in one piece, but if in pieces the joints should be well soldered. Also make soldered connection of rod to pipe.

(49) C. O. F. asks: What is it in Canadian kerosene oil that causes the discoloration of the chimneys, and also what gives it the unpleasant odor? A. The discoloration of the chimneys is produced by the volatilization of the sulphur, etc., which attacks the glass. Similarly the odor results from the sulphur; possible phosphorous and their combinations with carbon and hydrogen.

(50) W. M. L. wishes to know how oleate of copper for the removal of freckles is to be applied, how often, and in what consistency. A. The remedy should be used in the state in which it is received from the apothecary, and should be lightly applied to the spots with the finger upon retiring at night. It would be difficult to say how long it would take any remedy, internal or external, to effect a cure.

(51) L. H. C. writes: My lawn, not of great extent, is completely covered with dandelions, which are choking out the grass. Lawn was richly manured last fall, and they seem to thrive upon it. Can you or any of your readers suggest a method of killing them out? A. We know of no better way to eradicate dandelions in a lawn than to cut them out with a long, narrow knife. Run the knife down beside the root, loosening as much as possible of the root, and pull it out. The next best is to resod the lawn.

(52) G. W. asks how to make a good liquid barometer.

A. Camphor	2½ drachms.
Alcohol	11 "
Water	9 "
Saltpeter	38 grains.
Ammonium chloride	38 "

Dissolve the camphor in the alcohol, the salts in the water, and mix the solutions together.

(53) C. J. R. asks: 1. By what osmotic action or why liquids of different densities tend to mix, or project their particles through each other in opposition to the laws of gravity? A. Osmotic action is definable by its effects; its cause is not known, unless it be due to molecular motion. 2. Why given odors tend to shoot through still atmosphere at considerable velocity? A. The cause of the dissemination of matter producing the sensation of odor is unknown, except as being one of the phenomena of volatilization. 3. By what law magnetic atoms dart off from the poles of a magnet in ceaseless streams, or what motive force sends electric fluid through a wire at almost inconceivable velocity, leaving out that it comes through "nature"? A. Magnetic atoms, as such, are unknown, and electricity is only known by its effects.

(54) A. B. C. asks how the liquid slating used in painting the surface of blackboards is prepared? A. One gallon 95 per cent alcohol, 1 pound shellac, 8 ounces best ivory black, 5 ounces finest flour emery, 4 ounces ultramarine blue. Make a perfect solution of the shellac in the alcohol before adding the other articles. To apply the slating, have the surface smooth and perfectly free from grease; well shake the bottle containing the preparation, and pour out a small quantity only into a dish, and apply it with a new, flat varnish brush as rapidly as possible. Keep the bottle well corked, and shake it up each time before pouring out the liquid.

(55) W. says: 1. Some time since you gave a receipt for making ink as follows: 1 part of commercial nigrosin in 80 parts of water, etc.; does this mean 1 to 80 in bulk, or 1 to 80 in weight? A. Use parts by weight. 2. What percentage of cream should milk show in the lactometer? A. The lactometer shows the specific gravity of milk, from which the quantity of water that it contains is roughly estimated. The cream is determined by means of the creamometer.

(56) H. K. R. says: I have been trying to make a compound for producing the so-called Indian white fire, that is, a very intense light; the mixture I used consists of saltpeter 6 parts, sulphur flower 2 parts, black sulphite of antimony 1 part, but in spite of all my efforts it does not ignite readily, and burns only very slow, and often going out again. A. Use dry niter 24 parts, sulphur 7 parts, powdered charcoal 1; or instead of the charcoal 2 parts red sulphide of arsenic. Mix them intimately in an iron vessel, and ram the mixture into thick paper cylinders of about 3 inches in length by 1 inch diameter. These are kept in a dry place, and when one is required to be used it is set on end, and a piece of red hot charcoal placed upon it. See page 5055 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 317, for colored lights.

(57) L. H. M. asks: 1. Is resin oil a lubricator, and can it be mixed to advantage with different oils to make an axle grease for railroad axles? A. Resin oil is used as a lubricator, and is one of the ingredients in Frazer's axle grease. 2. Is it injurious to railroad axles, and, if so, in what does its injury consist; and what would be a proper proportion of resin oil to a gallon of oil? A. We think it might be objectionable for railroad use on account of its tendency to gum. 3. Can lime be used in an axle grease of this kind to make it hard? And how is this hardness produced with this substance? A. Both lime and magnesia are used for this purpose. 4. Can caustic soda be used to give a necessary degree of hardness to a grease of this kind and, if so, would it not cause combustion in a journal? A. Caustic soda would not be so desirable a hardening agent as lime. 5. Can you give me a receipt of a good axle grease? A. For use in;

Winter.	Summer.
35 parts	60 parts tallow.
10 "	8 " oil of resin.
65 "	40 " olive or rape oil.

See also the receipts on page 5039 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 316.

(58) C. A. B. says: To make artificial marble, suppose I wanted to mix 10 pounds of plaster of Paris: What would be the necessary quantities of water and alum? How long must the plaster of Paris soak? How long must it bake? When baked, ought it to be hard, or does the alum prevent it from becoming so? A. The process is generally conducted as follows: The plaster of Paris is mixed with a saturated solution of alum, and the mixture calcined until perfectly dry; then it is ground to powder, which if worked up with water the mass hardens, forming a satisfactory imitation of marble.

(59) E. E. asks for the best method of photographing on wood for engravers? A. Dissolve tannic acid in hot water, and make a white glue solution as thin as possible; first dip the block in the hot thin glue solution, allow to cool off, then dip in the hot tannic acid solution, and use when dried off. Some prefer the white of egg to the glue solution. You will have to experiment to learn just how to get the best results with these solutions in making the block ready for photographing.

(60) D. E. W. and H. P. ask for a chemical preparation that will permanently remove surplus hair from the face or neck without injuring the complexion? A. Both calcium and barium sulphide are used for this purpose. The following is likewise commonly employed: Mix 3 parts crystallized sodium sulphide, 10 parts finely powdered quicklime, and 11 parts starch. It should not be applied longer than 2 to 4 minutes. It is said to be "very effective and safe."

(61) A. M. L. V.—Wind your wire as in the drawings in SUPPLEMENT, leaving a space in the middle. If the coil is soaked in pure paraffine, it will improve it. You will find description of mercury contact breaker in almost any work on physics. Sound waves will travel against a wind, but will, of course, be somewhat retarded.

(62) J. L. K. asks: Is it practicable to run cog gearing 2½ and 3 inches in diameter 2,000 revolutions per minute? A. It is considered impracticable to run such small gearing at this speed.

(63) A. H. asks: Would a meniscus lens of larger diameter and longer focus (correspondingly) than that described in SUPPLEMENT, 252, work satisfactorily (say 4 or 5 inches diameter) for an astronomical telescope? A. Yes, if made of proportionately longer focus.

(64) G. P. asks if there is any duty on English goods shipped to Canada? A. In the absence of a reciprocity treaty, the Canadian tariff makes no distinction as to where the goods come from.

(65) J. B. asks if there is a way of incorporating zinc and glass by fusion, and if so, how? A. Metallic zinc cannot be incorporated with glass. It is too volatile. Its oxides may be mixed with melted glass.

(66) J. O.—Your question is very incomplete. Speed depends upon load, condition of track, and capacity of boiler to supply steam for high piston speed.

(67) C. H. P. asks: 1. What composition can be applied to pencil drawings to prevent them from rubbing off, without discoloring or injuring the paper, and how applied? A. The drawing is generally passed through a solution of equal parts of milk and water in such a way as to wet the paper through, but not enough to allow any of the liquid to run on the surface of the drawing. 2. Please give a receipt for making a wash for removing the black and tartar from the teeth without injuring the enamel? A. Use the softened and fibrous end of a wooden toothpick with fine pumice stone, until the tartar is thoroughly removed, washing the mouth with lime water; occasional use of the lime water, with proper care of the teeth, will prevent the tartar coming on again. None of the washes recommended for this purpose are of much value. 3. What horse power will a Backus water motor give with 90 pounds water pressure, 1 inch pipe, and ¼ inch jet? A. Three-quarters of one horse power. 4. Which of the following jets will give the most power to the above motor: ⅛, ¼, or ½ inch? A. A ⅜ inch jet is the largest you can use advantageously with a 1 inch pipe, and will give a little over 1 horse power. 5. Please give receipt for making paste that will keep? A. The best paste for general purposes is simply wheat flour beaten into cold water to perfect smoothness, and the whole just brought to a boil, while being constantly stirred to prevent burning. The addition of a few drops of creosote, carbolic acid, or oil of cloves will preserve it for years if kept covered. 6. Also a receipt for making mucilage such as is used on postage stamps and envelopes? A. Gum dextrin 2 parts, acetic acid 1 part, water 5 parts. Dissolve in water bath, add alcohol 1 part.

(68) W. W.—The "Universal Putz Pomade" consists of American bole mixed with sufficient oleic acid to form a paste, and perfumed with nitro benzol. The following is likewise said to be similar if not identical with the "Putz Pomade":

Levigated rotten stone	1 part.
Iron subcarbonate	3 "
Lard or olive oil	q. s.

To make the finished product the consistency of lard, perfume with oil of bitter almonds.

(69) F. S. P. asks: Suppose a very narrow pit 14,282 feet below the level of the sea or ocean, how much less than 30 pounds to the square inch would the atmosphere exert at the bottom of the pit? A. We have no records for so great a depth as this. The pressure is supposed to slightly increase in descending shafts about half a pound to 1,000 feet, which would make the pressure at such depth about 21 pounds to the square inch.

(70) E. K. says: I wish to use a fine metallic powder of iron and copper; could you advise me a cheap way to get it, in some quantity, possibly by grinding on emery wheels or else? The way of precipitation by hydrogen gas is too troublesome and expensive. A. A fine iron powder may be gathered in machine shops and foundries where much grinding is done with emery wheels. Copper powder may be obtained in the same way. We know of no trade in which copper is so ground.

(71) A. L. S. asks: Does it take more power to raise water out of a 160 ft. depth well with a 4 in. pipe than it does with an inch pipe, both pipes to have 2 in. cylinders at bottom of well? A. It takes less power by the difference in friction between the 4 in. pipe and the 1 in. pipe. With the small cylinder there will be no perceptible difference with a slow movement, the static pressure being the same in both pipes.

(72) E. B. H. says: I use considerable aluminum plate. My scraps I have not been able to remelt and roll out. I seem to destroy some properties of the metal in remelting. Anneal it as often as I will, it continues to crack or break in rolling Can you help me out? A. The melting of aluminum, if properly conducted, should yield good results. It fuses at about 700° C. In order to remelt aluminum scraps, a fusing mixture of common salt and potassium chloride must be employed, as the presence of other fluxes, such as borax, glass, etc., renders the metal very impure.

(73) W. H. H. asks: Can sperm oil be used again for lubricating purposes, after being used on an engine? A. Sperm oil that has been used on bearings is not suitable for reuse upon bearings or shafting, but is good for drilling or cutting threads, as bolts, nuts, etc., until entirely used up.

(74) A. P. L.—An ohm is a unit of electrical resistance which is equal to 330 feet of No. 9 iron wire (0·155 in. diameter). The term "mile ohm" means the weight in pounds of metal required to produce in a mile length of wire the resistance of one ohm.

(75) M. O. S. writes: During a heavy thunder storm which passed down the St. Lawrence, June 18, I noticed a somewhat strange phenomenon. While standing outside watching the progress of the storm, I saw a flash of lightning almost directly north at about 20 degrees from the horizon, followed by another and another, at, I may say, exactly the same elevation, flash succeeding flash, each one about 4 degrees due west from the preceding one. The whole succession of flashes extended from north to almost west, and from first to last occupied from 1½ to 2 minutes. It resembled exactly the flight of a firefly, the flashes occurring at about the same intervals which elapse between the flashes emitted by a firefly. What occasioned this form? A. Lightning takes the course of the least resistance. It is probable that the lightning followed a column of rarefied air, which remained undisturbed during the period of your observation.

(76) F. G. R. asks: Will you please tell me if I will be able to get anything that will be repelled by a magnet with the same power as soft iron will be attracted to it? A. Like poles of two magnets will repel each other with the greatest repellent force obtainable from magnets, but this force will not be equal to the attraction of either of the magnets for a piece of soft iron.

(77) J. H. T. asks for the most correct method of ascertaining the contents of a barrel or cask, the diameter of the head, the diameter at bung, and the length being given. You will see in Haswell's "Engineers' and Mechanics' Pocket Book," of the issue of 1878, page 102, an example thus: Diameter of head 17 inches, bung 19 inches, length 28 inches; volume, 7,689 cubic inches. Now, by what rule is this answer arrived at? I have figured it various ways, but cannot bring the answer as above. A. Find the mean diameter of the barrel, and the number of square inches in this curve, multiplied by the height of barrel in inches, will give the cubical contents. Owing to the difference in the forms of barrels and the different curves of the staves, it is impossible to make one rule for finding the mean diameter apply in all cases. We think the figures quoted are a misprint, as they do not correspond with our calculation; they are changed in a later edition, which gives rules for four varieties of casks.

(78) B. T. H. says: I have a portable gas machine, gas made from heavy oil passing over red hot retort, in use since 1856. The pipes from retort to gasometer have become partly filled with a thick tar. Can you suggest anything to pour in which will dissolve this tar? A. There is no practical or safe way of dissolving the tar out of the retort connections. Take them down and scrape them out. There should be a hydraulic main and a washer between the retorts and the gas holder, which will gather the surplus tar on a water surface and save the pipes from clogging.

(79) J. C. M. says: I have a parlor fountain, in which the water mixed with air runs through about 30 feet of glass tubing which gets very dirty, so we can't tell the difference between the bubbles of air or water (we use hydrant water). Can you inform me what to put in the water to clean the tubes and not hurt the zinc with which the tank is lined that feeds the fountain? A. Know of no better way than to take out the glass tubes and pour nitric acid through them. Fix the tubes so that the acid will run free. Make a little funnel of beeswax or paraffine around the top to enable you to pour the acid from a small bottle, catching it in a bottle at the bottom.

(80) C. P. asks for a receipt for a blue and white, for stamping on goods; one that will not rub off. A. The indelible blue coloring which is sometimes used consists of ultramarine mixed with burned linseed oil, ground together and printed on the white surface. It is practically the equivalent of blue printer's ink; the white coloring material which is similarly used consists essentially of white lead. The soluble colors which are applied are the simple ultramarine mixed with gum water, and likewise the dry white lead mixed with the same substance. The addition of a little potassium dichromate in the water added to the gum and then exposed to the light might possibly prevent its dissolving. Those who use these articles are very unwilling to give the formulas employed by them, claiming that they are trade secrets, for which they have paid money.

(81) J. D. P. asks: Who was the first person that invented a steamboat, and what part did George Fitch play in the steamboat world? A. There have been several claimants for the honor of being first in this field, and it is not quite clear how the credit should be divided; John, not George, Fitch built the first steamboat that was run in this country, making trips on the Delaware, above Philadelphia, in the summer of 1790.

(82) D. and R. ask for a receipt for coloring small tin articles different or various colors, by dipping them in some solution so as to give them a smooth, hard, and durable finish? A. There are no means of coloring tin except by lacquering and japanning. The latter is fully described in SCIENTIFIC AMERICAN SUPPLEMENT, 316, and for the former we would suggest that the articles be coated with some suitable metallic oxide or other coloring matter mixed with japan varnish and baked.

(83) J. D. F. says: 1. I have some old paint brushes which have become hard with paint; how can the paint be removed so as to make the brushes perfectly clean without injury to the bristles? A. To soften brushes that have become hard, soak them 24 hours in raw linseed oil and rinse them out in hot turpentine, repeating the process till clean; or wash them in hot soda and water and soft soap. 2. Can you tell me of something to put on awnings to prevent mildew? A. To remove mildew stains, mix well together two tablespoonfuls of soft soap, one of salt, two of powdered starch, and the juice of a lemon. Lay this mixture on both sides of the stain with a painter's brush, and then lay the articles on the grass, day and night, until the stain disappears.

(84) F. A. writes: I made a telephone as shown in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 142. The phones are made of ebony, and are perfect. Magnets are about as close as can be to the diaphragm. I cannot get them to work; like to know the cause. A. We cannot say where your trouble lies without knowing more of the details of the construction of the instrument. You do not say which kind of telephone you made. You may have a broken conductor. Your magnet may be closed by an iron armature. Your diaphragm may touch the end of the magnet. If you have used horse shoe magnets, see that like poles are in contact with the pole extension. See also that the pieces used to clamp the magnets together are not iron.

(85) J. H. asks how shoe polish is made, the quality used by street boot blacks? A. Day & Martin's celebrated English blacking consists of bone black in a state of powder mixed with sperm oil until the two are thoroughly incorporated. Sugar or molasses is then mixed with a small portion of vinegar and added to the mass. Sulphuric acid is next added, and when all effervescence has ceased, more vinegar is poured in until the mixture is of proper consistency. The formula for a French shoe dressing is given on page 355 of SCIENTIFIC AMERICAN for Dec. 8, 1883. On page 150 of SCIENTIFIC AMERICAN for March 10, 1883, several other formulas are given.

(86) H. P. asks: 1. How can mother-of pearl be bent and straightened after it is cut from the shell? A. Mother-of-pearl is generally used in small pieces and thin layers which are held in their position by japan varnish. (See page 5058, SCIENTIFIC AMERICAN SUPPLEMENT, No. 317.) In the compressed mother-of-pearl the shells are submitted to a strong heat, which separates them into thin scales; these are then pressed in the cylinders of a flattened roller, and afterward pounded in a mortar. It is then sifted to get rid of the dust, and the powder is treated with gelatine, and shaped in form. 2. How can bone and ivory be bleached without the direct action of the sun, for instance, by the use of some fluid? A. Hydrogen peroxide is used to bleach ivory and bone. See SCIENTIFIC AMERICAN SUPPLEMENT, 339.

(87) "Buttons" asks: Can you kindly inform me in your answers to correspondents. 1 What articles or tools are used by professionals in stamping on felt, canvas, or other goods for embroidering, marking, or braiding, etc.? 2. Where these articles or tools could be purchased? A. 1 and 2. The tools are few and simple; they cannot be purchased, and are made to order by the special individual using them from his own designs. 3 If there is any other way more practical and convenient for a lady to do her own stamping? If so, how? A. The process is not practicable or convenient for a lady to undertake; it would be far cheaper in every instance for her to purchase the stamped pattern rather than to undertake the preparation herself. Where a dealer can, by having special stamps cut for him, sell a large number of similar patterns, the price will be considerably less than if a single one were prepared.

(88) A. B. says: I am putting a steam furnace into my house to heat it, and wish to wrap the steam pipes with common building paper. Can I saturate or cover the paper with a cheap solution that will prevent the paper from taking fire with the steam at 10 pounds? A. There is no danger from wrapping the steam pipe with paper in a low pressure heating apparatus. Old carpet cut in strips, or listing, makes a very good felting for the inside or next the pipe. The paper should be put on loosely and tied with twine. You may fireproof the paper by dipping it in a strong solution of borax and sal ammoniac or alum.

(89) H. D. Q.—Probably the best battery for your use is the Bunsen bichromate or electropoin battery. It is moderately constant, and has a high electromotive force. For a motor to be used only occasionally, the plunging bichromate battery is best. For full description of batteries see SUPPLEMENT 157, 158, and 159. You will find small electric motors described in the back numbers of the SUPPLEMENT.

(90) R. F. says: I have some monthly roses in my yard, and I find that the ants eat the leaves, and are always on them. I have tried kerosene and milk diluted with water, but it appears to kill the leaves, and still it does not kill or drive away the ants. Can you give me a remedy? A. We do not know of anything better than to put a ring of soft tar around the stems of the rose plants near the ground. Shake off all the ants, and see that all other communication between the leaves and ground is cut off. Wet the surface of the tar ring occasionally with kerosene oil to keep the tar soft. Ants do not love tar rings. You may also poison them by feeding them with mutton tallow into which a little arsenic has been mixed.

(91) S. R. G. says: A dry piece of lumber, a foot square, will soak up a half pint of water, and swell a half inch in width. A duplicate piece may be saturated with oil until it will bend like leather, and yet it will shrink. Why is this? A. The theory is that the water, having an affinity for the particles or atoms of the fiber, penetrates and unites with it, causing the fibers to swell; whereas the oil only enters the pores and lubricates the spaces between the fibers, causing them to easily move upon each other, making the wood elastic, the oil having no affinity for union with the particles of the fiber.

(92) B. F. W. writes: I have an engine with cylinder 10x12, rated at 20 horse power (center crank), boiler 42 inches by 11 feet with 36 three inch tubes, steam pipe 2 inches, exhaust pipe 2 inches (all new); have not power enough to run a 50 inch saw so as to cut more than 4,000 feet per day. Engine seems to run free and easy with 20 to 30 pounds steam while running light machinery in a sash factory, but nearly chokes down while running through a log with a 50 inch saw with steam at 80 to 100 pounds. What should be done to increase the power? What size should the exhaust pipe be? A. The exhaust pipe should be 2½ inches and as short as possible. If there is ample supply of steam, you might increase the speed of the engine by changing some of the pulleys, and gain a little power. Really, the engine is too small for the saw.

(93) J. D. C. asks: Does the report of a cannon fired over the water where a person has been drowned, bring the body to the surface? If it does, can you explain upon what principle this takes place? A. The firing of cannon near the spot where the body of a person that has been drowned is supposed to be lying upon the bottom, has in some cases caused bodies to rise: sometimes it fails. It is supposed that bodies that are liable to rise upon the firing of cannon are almost in an equipoise upon the bottom, and the intense vibration of the air, and consequently the water, tends to slightly distend such parts of the viscera as may contain gases under slight pressure. In this way a very slight distention of confined gas would overcome the difference in gravity between the body and the water, and cause the body to rise.

(94) M. D. asks: 1. How can I temper my two inch auger? It is soft. A. Temper an auger, if it is of steel by heating in a charcoal fire, a full or cherry red, and dip in water. If it is hard by trial with a file, you may have to draw the temper to a dark straw or light blue. If it does not harden, it is probably iron that has been casehardened. Any blacksmith can recaseharden it. 2. Will beef cook tenderer under 100 pounds pressure to the square inch than it will in open kettle? Or will 200 steam pressure be better? A. Beef cooks tender under slight pressure with steam; one or two hundred pounds pressure will disintegrate it, and destroy its flavor. 3. Ought not a water pump to work, working cylinder 27 square inches surface on piston of low pressure cylinder, 3 pounds pressure to square inch, piston one inch square, working against 70 pounds pressure to the square inch? A. You have 81 pounds gross pressure upon your steam cylinder, against 70 pounds upon the water cylinder, only 10 pounds difference, which is not enough to overcome the friction; you should have 50 per cent more steam pressure, or about 4½ pounds.

(95) S. G. N. says: When turning shafting, one center has to be dug over, and quite frequently the shaft has to be straightened after it has been reversed in the lathe. Now, what is the cause of this? A. We think the trouble is with the hole in the spindle There are very few lathes that have the hole absolutely true; you turn up your center, as you think, perfectly true, take it out, harden it, and put it back in some other position, and although you may not observe upon the taper point that it is not running true, it may nevertheless be out one-sixty-fourth of an inch. Springing in hardening is also a cause of eccentric center The pressure of the dog might also cause eccentricity with a blunt center; in this case the shaft would not be round.

(96) C. W. W. asks: What amount of hydrogen can be obtained from one cubic foot of water, by passing its steam over red hot iron turnings in iron retorts? A. One cubic foot of water, theoretically, will produce about 1,400 cubic feet of hydrogen and 700 cubic feet of oxygen. 2. What amount of iron turnings will it take to absorb the oxygen of the cubic feet of water by passing the steam over them in the manner stated. This will require about 192 pounds of iron for its absorption. 3. What amount of heating surface will it take to convert the one cubic foot of water into steam in one hour? A. To convert a cubic foot of water into steam in one hour will require from 10 to 15 square feet boiler heating surface, according to conditions of pressure, etc.

(97) C. W. W. asks: 1. What is the lifting power of 1,000 cubic feet of hydrogen gas, made by passing steam through red hot iron turnings, and purified in lime? A. The lifting power of pure hydrogen gas is 71 pounds per thousand cubic feet. In practice, owing to diffusion through the pores of the balloon, this would be considerably reduced, say 25 per cent to 50 per cent. 2. Would a cast iron cylinder 8 inches in diameter, half an inch thick and 8 feet long, do for a generator? A. The cylinder suggested is rather thin. 3. What size steam boiler would be necessary for generating the steam? A. The size of the boiler must be estimated on the basis that 11 feet of water will give 21 feet of hydrogen. 4. How often would the retort need recharging? A. Assuming that the retort would hold one-quarter of its internal volume of metallic iron in the form of borings, etc., one filling would yield about 3,000 cubic feet of hydrogen, if the iron was completely decomposed. 5. What amount of gas could be made in one hour? A. This depends on so many things that it is impossible to more than guess at it. Hydrogen is very troublesome to handle, on account of its diffusion.

(98) C. C. J. writes: I have a large number of India rubber articles, upon which I wish to put a firm, durable, white surface, as near an imitation of porcelain as possible, without being liable to crack or break off. The articles mentioned are for out door use, and must be weatherproof How shall I proceed? A. If the articles are of soft rubber, we do not think it possible to effect; if of hard rubber, it would be impossible to add a porcelain-like coating, for that would necessitate baking the articles, under which circumstances they would melt. We think therefore the most satisfactory thing to do would be first to apply some coloring substance in the way of a thin paint, and then finish by coating the objects with some of the best body wearing varnish.

(99) W. S.—Panclastite consists of about equal parts or carbon disulphide and hyponitric acid, and it is exploded by means of mercury fulmlnate or gunpowder.

(100) A. W. G. asks (1) how long it will take to let air out of a cylinder measuring 1 cubic foot, compressed to 300 pounds to the square inch? The hole to be an eighth of an inch in diameter. A. A rule for determining this will be found on page 891 of Clark's Rules and Tables for Engineers. 2. How is it that we don't see anything more about driving boats by pneumatic pressure? I've a boat partly made to be driven that way, but am afraid it will cost as much to compress the air as it would to furnish steam. A. Because there has been no economical success; the power developed from compressed air is often not more than about 40 per cent of that required for the compression.

(101) J. W. asks: How is the best piano polish made? A. We would recommend you to try the following: Very pale shellac 5 pounds, mastic 7 ounces, alcohol (90 per cent) 5 or 6 pints; dissolve in the cold with frequent stirring.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. W.—The specimen is ordinary mica, and if the find runs like the sample it is of no value. Large sheets are frequently found, which can be used for stoves and the like; in such a condition it sometimes becomes worth as high as $10.00 per pound. The specimen also contains garnets.

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July 1, 1884,

AND EACH BEARING THAT DATE.

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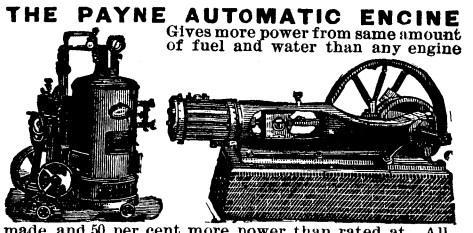

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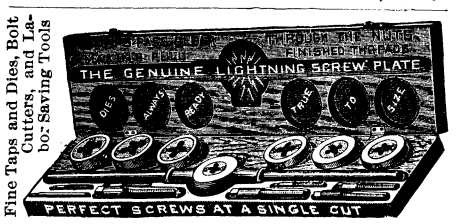

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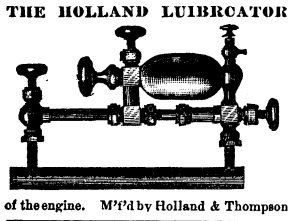

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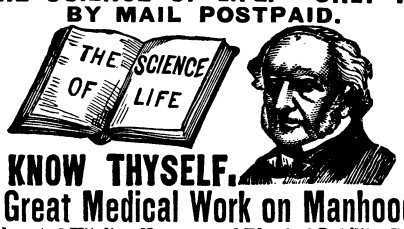

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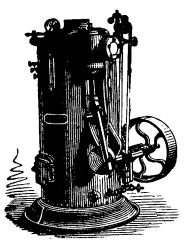

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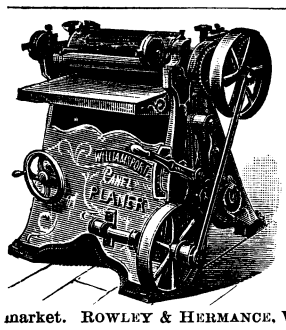

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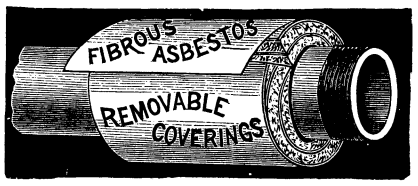

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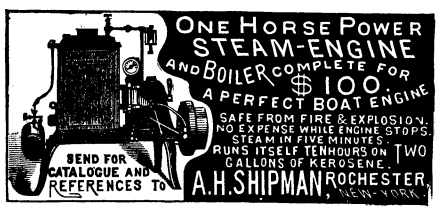
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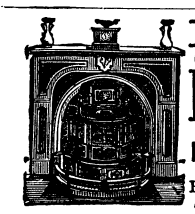

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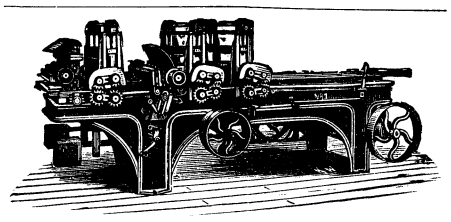

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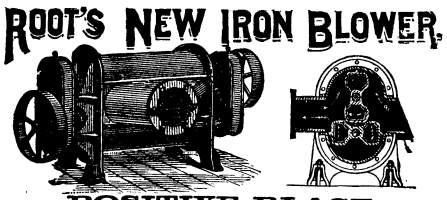

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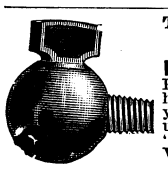

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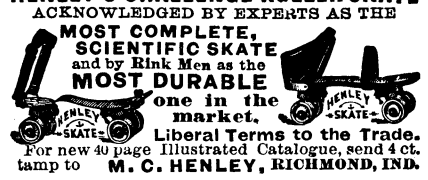

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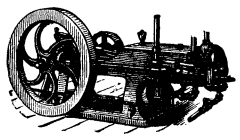

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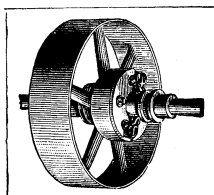

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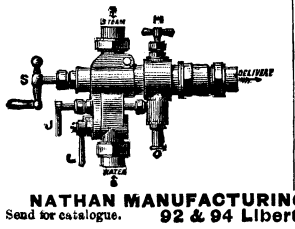

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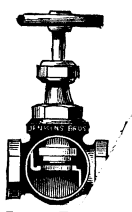

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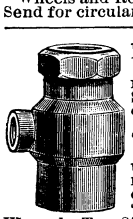

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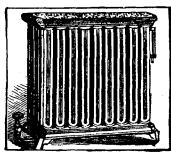

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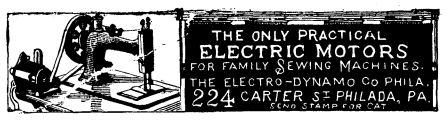

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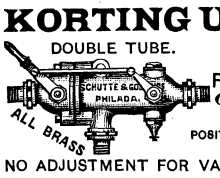

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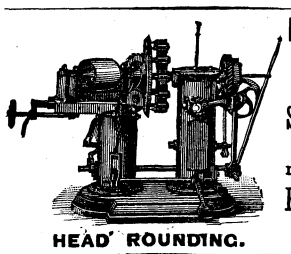

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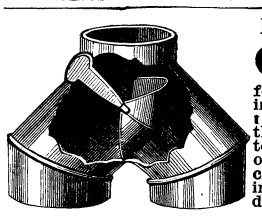

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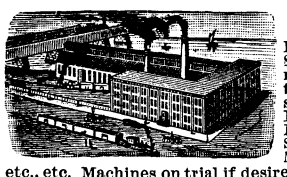

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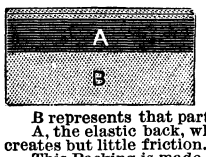

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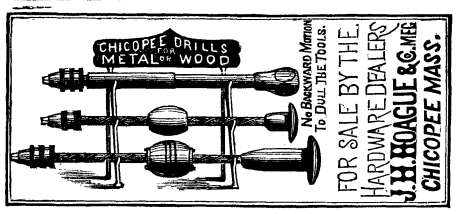
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